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FROM

U. S. Hydrographic Office.

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U. S.—HYDROGRAPHIC OFFICE.

SAILING DIRECTIONS

FOR

LAKE ERIE AND LAKE ONTARIO,

ST. CLAIR AND DETROIT RIVERS,

AND

LAKE ST. CLAIR.

Price, $1.00.

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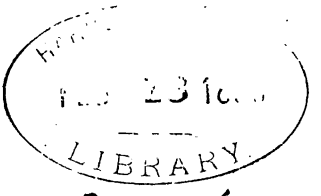

From the
Hydrographic Office.

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PREFACE.

With the present volume the set of Sailing Directions for the Great Lakes is completed, with the exception of a small supplement for the St. Lawrence River to Montreal.

This work is published in the following parts:

Part I, Lake Superior, St. Marys River, and Straits of Mackinac.

Part II, Lake Michigan, Green Bay, and Straits of Mackinac.

Part III, Lake Huron, St. Clair and Detroit rivers, and Lake St. Clair.

Part III, Supplement, North Channel and Georgian Bay.

Part IV, Lake Erie and Lake Ontario, St. Clair and Detroit rivers and Lake St. Clair.

Part IV, Supplement, St. Lawrence River to Montreal.

At Montreal it will connect with Hydrographic Office publication No. 100, thus giving complete sailing directions from Duluth, Minn., to the Atlantic Ocean.

The general description of Lake Erie and Lake Ontario has been obtained from various encyclopedias, and the description of the coast and harbors chiefly from the annual reports and bulletins of the Chief of Engineers, U. S. Army, and from charts published by the United States Engineers.

The lighthouses, lightvessels, ranges, beacons, buoys, and daymarks are described from the publications of the U. S. Lighthouse Board, and the Department of the Marine and Fisheries, Canada.

Through the courtesy of local authorities much valuable data has been procured.

Since the first issue of such a work may lack completeness, the Office depends upon the cooperation of those who dwell near the lakes, as well as of those who navigate them, for prompt information concerning any errors or omissions. Such cooperation is earnestly requested.

The articles appended to this work are such as may be of interest and value to the mariner:

"The New Rules of the Road of the United States" (Great Lakes).

"Signals: Weather, Storm, and Temperature, with Diagrams, United States and Canada."

"Brief Rules for the Use of Oil," with diagrams.

"Anchoring and Riding out Gales in Deep Water."

"Currents of Lake Erie and Lake Ontario," with map, United States Weather Bureau.

"Life Saving Service," with diagrams.

"General Information."

The thanks of the Office are due, for valuable information furnished in response to its circular letter, to—

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This work has been prepared by Lieutenant D. H. Mahan, U. S. Navy, in charge of the Division of Sailing Directions; assisted by Mr. R. C. Ray, U. S. Navy.

The charts and illustrations were prepared under the direction of Mr. G. W. Littlehales, in charge of the Division of Chart Construction of this Office.

C. D. SIGSBEE,
Commander, U. S. Navy, Hydrographer.

U. S. HYDROGRAPHIC OFFICE,
WASHINGTON, D. C., *January*, 1896.

NOTE.

The bearings, courses, and trend of the land are true, and given in points and degrees.

The directions of the winds, the points from which they blow; the directions of the currents, the points toward which they set.

Distances are expressed in nautical miles (the equivalent statute miles follow in parentheses).

It is well to remember that on Hydrographic Office charts for the Great Lakes bearings and courses are *true*; distances are given in *nautical* miles (the equivalent statute miles follow in parentheses).

On U. S. Engineer charts bearings and courses are *true*; distances are given in *statute* miles.

On British Admiralty charts, bearings and courses are *magnetic*; distances are given in *nautical* miles.

U. S. Engineers' Lake Survey charts to be used in connection with these sailing directions.

ST. CLAIR RIVER.

No. 37. St. Clair River.

LAKE ST. CLAIR.

No. 41. Lake St. Clair.

DETROIT RIVER.

No. 56. Detroit River.

LAKE ERIE.

No. 75. Lake Erie.
No. 73. Coast Chart No. 7, Lake Erie.
No. 72. Coast Chart No. 6, Lake Erie.
No. 71. Coast Chart No. 5, Lake Erie.
No. 70. Coast Chart No. 4, Lake Erie.
No. 69. Coast Chart No. 3, Lake Erie.
No. 68. Coast Chart Nc. 2, Lake Erie.
No. 74. Coast Chart No. 1, Lake Erie.
No. 43. Sandusky Bay.

NIAGARA RIVER.

No. 48. Niagara Falls.

LAKE ONTARIO.

No. 61. Lake Ontario.
No. 67. Coast Chart No. 5, Lake Ontario.
No. 66. Coast Chart No. 4, Lake Ontario.
No. 65. Coast Chart No. 3, Lake Ontario.
No. 64. Coast Chart No. 2, Lake Ontario.
No. 60. Coast Chart No. 1, Lake Ontario.

The following U. S. Hydrographic Office charts also cover the coasts described:

No. 1477. Lake Erie and Lake Ontario.
No. 1462. Toronto Harbor.
No. 1480. Detroit River.
No. 1200. Erie Harbor.
No. 1466. Mohawk Bay.
No. 1468. Cleveland, Ohio.
No. 1499. Charlotte Harbor.

The following British Admiralty charts also cover the coasts described:

No. 332. Lake Erie.
No. 330. St. Clair Lake and River.
No. 490. Lake Erie, west end.
No. 678. Lakes Erie and Huron.
No. 333. Mohawk Bay.
No. 336. Niagara River.
No. 1152. Lake Ontario.
No. 337. Toronto Harbor.
No. 259*a*. River St. Lawrence, Ogden Island to Kingston.

CHAPTER I.

ST. CLAIR AND DETROIT RIVERS, AND LAKE ST. CLAIR.

ST. CLAIR RIVER.

St. Clair River, the outlet of Lake Huron, commences at the southern end of this lake, where the shores of the United States and Canada nearly meet. This river, in connection with Lake St. Clair and the Detroit River, forms the link between lakes Huron and Erie. It is 46 miles in length, counting from the 20-foot curve in Lake Huron to the 20-foot curve in Lake St. Clair. As the proposed improvements by dredging will form a continuous deep channel between these curves, it is but right to class them with the river proper, which extends from Fort Gratiot to the mouth of the South Channel.

The proposed channel, from the 20-foot curve in Lake Huron into the river and terminating just inside of Fort Gratiot lighthouse, is to have a depth of 21 feet, with a width of 2,400 feet at the Huron end, which will be continued to the deep water in the St. Clair River. January, 1895, the available depth was 17 feet. Thence through the river the navigation is easy until leaving the South Channel, when the flats are encountered.

St. Clair Flats Canal.—Before the construction of this canal the St. Clair River emptied into Lake St. Clair through seven principal mouths or passes, the one most used being the South Channel. In 1866, in order to obtain a straight channel across the flats, a canal was commenced, and in 1871 finished to a depth of 13 feet, with a width of 300 feet, the channel being bounded on either side by a dike. In 1873 the channel was deepened to 16 feet for a width of 200 feet. In 1893 the project was to dredge the area between the dikes to a depth of 20 feet, and to continue a channel above the canal into the river, and below the canal into the lake.

The northern or river end of this channel has a bottom width of 650 feet, and from that narrows gradually until the dikes are reached. Between the dikes a depth of 20 feet is to be maintained with a width of 300 feet for a distance of 7,221 feet. From the lake end of the dikes the width increases gradually until a bottom width of 800 feet is attained, and this width is continued to the 20-foot curve. A depth of 20 feet could be carried from this point across Lake St. Clair were it not for the shallow water known as the

Grosse Pointe Flats.—On these flats at the ordinary stage of the lakes a depth of 16 feet can be carried, but during low water it is difficult to carry more than 15 feet.

To improve the carrying capacity of this part of the chain of navigation, it is proposed to dredge a channel having a 20-foot depth with a width of 800 feet from the 20-foot curve in Lake St. Clair to the deep water in the Detroit River.

Detroit River.—From the southern end of Grosse Pointe Channel to the southern end of the ship canal below Amherstburg this river is 32 miles long, with a navigable depth of water for large vessels of from ¼ to ½ mile in width until the vicinity of Ballards Reef lightboat is reached, whence the channel narrows decidedly and is filled with shoal spots having but 17 feet of water on them.

These spots are about the center of the main channel and extend from the lightboat to Fort Malden. The channel from Fort Malden on is narrow, about ⅛ mile, until ¼ mile below Bois Blanc lighthouse; thence to the cut which is to be dredged through the bar the channel widens. This cut is to be 800 feet wide and to carry a depth of 21 feet from the Detroit River into Lake Erie, a distance of 2¼ miles.

NORTHERN APPROACH TO ST. CLAIR RIVER.

From Lakeport, in Michigan, the coast of Lake Huron trends SSE. ½ E. to the mouth of the St. Clair River, and the coast can be approached within ¾ mile until near Lake Huron lightvessel, when the ranges must be taken up for entering the river.

From Errol, on the Canadian side, the coast trends W. by S. and it is safe to approach within ½ mile until close to Fort Gratiot lighthouse.

In the approach to the river, if coming from the northward, vessels of light draft should pass close to the lightvessel, keeping it to port; vessels of greater draft can find deeper water by keeping the lightvessel to starboard $1\frac{3}{10}$ ($1\frac{1}{2}$) miles away and continuing to approach the Canadian shore until Fort Gratiot light bears SW. by W. ¼ W. (S. 59° 03′ W.), distant 2 (2¼) miles, whence a course WSW. ¼ W. (S. 70° 18′ W.) will lead through 4 fathoms until the Fort Gratiot range is made, on which range vessels should enter the river. When the channel is cut from the lake into the river all vessels can use it.

If coming from the eastward, vessels should bring Fort Gratiot light to bear SW. by W. ¼ W. (S. 59° 03′ W.), distant 2 (2¼) miles, and then keep a course of WSW. ¼ W. (S. 70° 18′ W.) until on the Fort Gratiot range.

DIRECTIONS FOR ST. CLAIR RIVER.

U. S. Engineers' Chart No. 37.

Fort Gratiot Range.—On the west bank of this river and near the Grand Trunk Railway freight house and dock at Fort Gratiot is a fixed red light,

shown from a telegraph pole surmounted by a white triangle for a day mark; the light is 57 feet above the lake level.

About 300 feet SSW. $\frac{3}{4}$ W. (S. 30° 56′ W.) is a second red light at a height of 80 feet above the lake level and shown from a white pyramidal framework tower with a day mark 14 feet long and 10 feet wide.

This range will carry deep water into the river and clear the 20-foot spot lying SE. 300 yards from Fort Gratiot lighthouse.

After passing this 20-foot spot a mid-channel course should be kept until near the mouth of Black River when the deepest water will be found near the Canadian shore; a shoal makes out from the mouth of Black River 1,200 yards to the southward with a greatest width of 500 yards; 12 feet can be carried over this shoal, but a lookout must be kept for some spots of gravel and rock on which there are but 10 feet.

Buoy.—A black spar buoy, 25 feet in length, is moored in 15 feet of water (mean depth) to mark the easterly side of this shoal.

Caution as to Anchorage.—From Fort Gratiot light to below the rapids the holding ground is rocky and bad. Off Port Huron and Sarnia it is clay and good. Vessels should anchor as close to shore as safety will permit so as to leave the mid-channel clear for passing vessels.

Black River.—If intending to enter this river it is well to know that a channel has been dredged from the St. Clair River to Washington avenue. The width varies from 150 feet at the mouth to 50 feet at the upper end. January, 1895, the available depth at low water near the mouth was 15 feet, near the upper limit of improvements 10 feet.

Having cleared the shoal off Black River, a mid-channel course will carry deep water until approaching Stag Island, which, with the shoals projecting from its north and south ends, divides the river and forms two narrow but deep channels, through either of which deep water can be carried, remembering that in the Michigan side channel there is a 15-foot spot a little below Stag Island and nearer to the Michigan shore. The Canadian Channel is clear.

Corunna Range (Canadian).—The front light, a fixed white light, is shown from a white, skeleton-framed tower with an inclosed top, the side facing the water being slatted. It is 48 feet above high water and visible 4 (4½) miles.

The rear light, a fixed white light, 67 feet above high water, visible 4 (4½) miles, stands 568 feet S. by E. $\frac{3}{16}$ E. (S. 13° 21′ E.) from the front light. It is shown from a square white tower.

Both of these towers are in the village of Corunna, the front light being near the old wharf at the foot of Fane street, whilst the rear light is on the west side of Beresford street. The course S. 13° 21′ E. carries through the best water in the Canadian Channel past the shoals at the head of Stag Island as also past the shoals off the mouth of Talfords Creek.

Stag Island.—The island proper is about 1¾ miles long with a shoal projecting to the northward for nearly ¾ mile.

Buoy.—Near the northern edge of this shoal a 25-foot spar buoy, painted in red and black horizontal stripes, is moored in 16 feet of water; the shoal extends a short distance north from this buoy.

There is also a shoal which extends ¾ mile south from the island.

Buoy.—A 20-foot spar buoy, painted red and black in horizontal stripes, is moored in 12 feet of water, on this shoal.

Caution.—A short distance to the southward from this buoy are two shoal spots of 17 feet water, and one of the same depth west from the buoy and nearly in mid-channel on the Michigan side.

Having passed the shoals near Stag Island, deep water continues for 1½ (1¾) miles to a shoal nearly in mid-channel and extending from off Mooretown, Canada, to the mouth of the Pine River, Michigan. The shoal water (18 feet) extends for a distance of nearly $1\frac{3}{10}$ (1½) miles, with a least depth, opposite St. Clair, of 4 feet. The shoal is marked by two buoys, and is known as St. Clair Middle Ground.

Buoys.—A 25-foot spar buoy, painted in red and black horizontal stripes, is moored near the north end of this shoal in 16 feet of water, and is about 650 yards W. ¼ S. from the mouth of Baby Creek, Canada.

A 25-foot spar buoy, painted in red and black horizontal stripes is moored near the south end of this shoal in 17 feet of water and is about 450 yards ENE. from the north side of the mouth of Pine River.

Pine River.—This river empties into the St. Clair River at St. Clair. There is a dredged channel from its mouth to the shipyard, 10 feet deep and from 75 to 100 feet wide.

From the shoals off Pine River the channel is clear until Marine City is reached, a distance of 6¾ (7¼) miles. Off Marine City, and just to the northward of Woodtick (Fawn) Island is a shoal nearly one mile long, with a least depth of 16 feet and not buoyed. The main channel is on the Michigan side until Woodtick Island is passed, and there is a narrow channel on the Canadian side.

Woodtick Island.—This island with its shoals is 1½ miles long by ⅝ mile wide; the shoals are marked by buoys.

Buoys.—A 25-foot spar buoy, painted red and black in horizontal stripes is moored in 16 feet of water on the shoal extending north from Woodtick Island and about 900 yards N. by W. ¼ W. from the northern end of that island; the shoal extends to the northward beyond the buoy.

A 20-foot spar buoy, painted red and black in horizontal stripes is moored in 13 feet of water on the end of the shoal extending to the southward from Woodtick Island and is about 700 yards S. by W. ⅝ W. from the south point of that island.

Belle River.—This river, on the Michigan side, empties into the St. Clair River just above the northerly end of Woodtick Island, and in the south end of Marine City. It has a dredged channel 50 feet wide and about 11 feet deep from the mouth to the first bridge, and thence to the Broadway bridge a vessel can carry 10 feet.

From the buoy south of Woodtick Island a mid-channel course can be kept until off Babys Point.

Chenal Ecarté (Canadian) is one of the seven mouths of the St. Clair River, and at Babys Point takes its direction to the southeastward. It is very narrow and navigable for vessels drawing 16 feet. About 5 (5¼) miles from Babys Point a second channel (Johnston) makes off to the southward.

About 3 (3½) miles farther on, Bear Creek empties into Chenal Ecarté. Neither of the channels empty into deep water.

FROM BABYS POINT THROUGH SOUTH CHANNEL.

U. S. Engineers' Chart No. 41.

A mid-channel course until the upper range on Russell Island is made.

Upper Range Lights.—A fixed red light, No. 12, is shown from a tripod, with a target for a day mark, at a height of 12 feet above the river level.

A second fixed red light, No. 11 (it shows white down stream to Fish dock), 25 feet above the river level, is shown from a mast on a cluster of piles, with a target for a day mark. The piles are in the water abreast a clump of trees on Russell Island and 1,500 feet SSW. ¼ W. (S. 25° 18′ W.) from the front light. (This light is also the rear light of the lower range.)

Buoy.—A 25-foot spar buoy, painted in red and black horizontal stripes, is moored in 16 feet of water and 900 yards N. by E. ¾ E. (N. 19° 41′ E.) from the upper red light on Russell Island.

In proceeding down the south channel bring the range a little on the starboard bow, giving the buoy a clearance of at least ⅛ mile. (Keeping this range will carry into 14 feet of water off the buoy.) This course can be carried until the middle light on Russell Island is abeam, when the course should be gradually changed to the southwestward until the lower range on Russell Island can be made.

Lower Range Lights.—A fixed white light, No. 10, is shown from a tripod, with a target for a day mark, in the marsh. It is 12 feet above the river level.

A second white light, No. 11, 25 feet above the river level (it shows red upstream to Babys Point), is shown from a mast on a cluster of piles, with a target for a day mark. It is 1,800 feet NE. ⅜ N. (N. 40° 46′ E.) from the front light. (This light is also the rear light of the upper range.)

This range should be made about ¾ mile below the lower white light, and the range can thence be carried to and a little below the Fish dock, when will be made the

Herson Island Lower Range.—A fixed white light, No. 8, 12 feet above the river level, is shown from a cluster of piles, with a target for a day mark. It stands in the water. (This light is also the front light of the Herson Island upper range.)

A fixed red light, No. 7, 20 feet above the river level and 1,050 feet SW. by W. ¼ W. (S. 59° 03′ W.) from No. 8, is shown, in the marsh, from a tripod with a target for a day mark.

Soon after heading on this range should be seen the

Squirrel Shoal Buoy.—A 25-foot spar buoy, painted red, moored in 17 feet of water off a shoal on which a depth of 13 feet has been found.

When abreast of this buoy the course should be changed gradually to the southward, keeping closer to the Michigan shore for the deeper water. When a little below the red light, No. 7, of the lower range, a buoy on the Canadian side, should be seen and when it bears nearly south the upper range should be taken.

Squirrel Island Buoy.—An 18-foot spar buoy, painted red, is moored in 11 feet of water to mark the edge of the flat off Squirrel Island. It is 800 yards S. 3° E. from the red light, No. 7.

Herson Island Upper Range.—A fixed white light, No. 8, 12 feet above the river level, is shown from a cluster of piles, with a target for a day mark. It stands in the water. (This light is also the front light of the Herson Island lower range.)

A fixed red light, No. 9, 25 feet above the river level, is shown from a tripod, with a target for a day mark. It is 1,200 feet N. 21° E. from light No. 8, and with it forms a range which can be carried past Bassett Channel, one of the seven original outlets of the St. Clair River.

Opposite the head of Bassett Channel is the

Southeast Bend Upper Light, No. 6, a fixed white and red light, showing from a cluster of piles and 12 feet above the river level. It shows white upstream and when it changes to red the course should be gradually changed to the southwestward for rounding the Southeast Bend. A mid-channel course should be kept past the next two lights.

Southeast Bend Middle Light.—No. 5 is a fixed red light, 12 feet above the river level, on a cluster of piles.

Southeast Bend Lower Light.—No. 4 is a fixed red and white light, showing the red upstream, and changing to white at the time a vessel should change its course to take the range.

Lower Reach Lower Range.—No. 3, the front light of this range, is a fixed white light shown from a cluster of piles with a target for a day mark. It is 12 feet above the river level.

No. 2, the rear light, is a fixed red light, 25 feet above the river level, shown from a tripod with a target for a day mark. It is 1,000 feet N. 56° W. from No. 3.

Light No. 2 is also the rear light of the Lower Reach lower range.

This range will carry nearly a mid-channel course through the upper part of the Lower Reach, but do not go too close to the Canadian side. A vessel keeping to the northward of a line joining lights Nos. 4 and 1, will keep off the shoals. Do not go to the northward of a line joining lights Nos. 3 and 4, but on approaching that line, if on the range, the course can be gradually changed to the west and a mid-channel course will carry past the lights until the lower range is nearly made. Do not go to the westward of this lower range.

Lower Reach Upper Range.—No. 1, the front light of this range, is a fixed white light 12 feet above the river level. It is shown from a cluster of piles, with a target for a day mark.

No. 2, a fixed red light, 25 feet above the river level and 900 feet N. 60° E. from No. 1, is the rear light of this range as also of the upper range.

Vessels should not go northward of this range, but should keep close to it until nearing the Star Island Hotel, when a course more in mid-channel should be kept.

When $\frac{3}{8}$ mile to the southwestward of Star Island Hotel a course SW. $\frac{3}{8}$ S. (S. 40° 46′ W.) with the lighthouse on the upper end of the west pier of the United States Ship Canal nearly ahead, will carry in deep water to the canal. At this entrance to the canal the width is 296 feet. There is a light on each end of the west pier.

St. Clair Flats Canal Lights.—A fixed red light visible 11¼ (13) miles, and 45 feet above the river level is shown from an octagonal tower, rising from the corner of a dwelling, both being built of red brick. It is on the NE. end.

A fixed red light visible 11¼ (13) miles, shown from the same description of tower and at the same height above the lake level is on the SW. end of this canal in Lake St. Clair.

DIRECTIONS ACROSS LAKE ST. CLAIR.

U. S. Engineers' Chart No. 41.

From the lighthouse on the SW. end of the west pier a course of SW. (S. 45° W.) for 12½ (14½) miles will carry to the Grosse Pointe Beacon light, which leave to port, passing between it and the buoy near it. Before reaching the beacon light the vessel will have passed

Grosse Pointe Lightvessel.—No. 10 is moored in 16 feet of water, 1½ (1¾) miles S. 52° E. from Grosse Pointe.

The lightvessel is a scow with one mast, with a circular cage-work day mark at the masthead. The hull is painted red with the name in large

black letters on each side, and "No. 10" on the stern. The day mark and topmast are painted black.

The light is fixed white, 25 feet above the lake level, and visible in clear weather 10¼ (11¾) miles.

Fog Signal.—During thick weather a bell is rung.

Buoy.—A 25-foot spar buoy, painted black, is moored 700 feet NW. of the lightvessel. It marks a 15-foot patch.

By the above course, SW., vessels leave the lightvessel and buoy to port, and keep the deepest water shown on the chart.

Grosse Pointe Beacon Light.—A fixed red light, 37 feet above the water is shown over a fixed white light, 30 feet above the water, from a cluster of piles 13 feet in diameter. On this beacon is a lamp room surmounted by a mast, from which the lights are shown. There is also a day mark of slats painted white. The beacon is 2⅜ miles ENE. ⅝ E. (N. 74° 32′ E.) from Windmill Point lighthouse.

Detroit River (head of) Buoy.—A 25-foot spar buoy, painted black, is moored in 16 feet of water 400 yards NW. from the beacon.

Vessels should pass between this buoy and beacon and with them abeam should change course to SW. by W. ¾ W. (S. 64° 41′ W.) until abeam of Windmill Point light, distant ¼ mile.

DIRECTIONS FOR DETROIT RIVER—MAIN CHANNEL.

U. S. Engineers' Chart No. 56.

Windmill Point Light.—A fixed white light varied by a red flash every 15 seconds, visible 12¾ (14¾) miles is exhibited, 55 feet above the lake level, from a conical white tower connected with a red brick dwelling by a covered way. The tower is on Windmill Point, the north side of the entrance to the Detroit River.

The course SW. by W. ¾ W. (S. 64° 41′ W.) will carry in between Windmill Point and Isle aux Peches, which island is surrounded by shoal water with a spit off the west end. This course can be kept until on the

Windmill Point Range.—A fixed red light is shown, 34 feet above the river level, from a square, red, pyramidal, skeleton tower, the upper part being inclosed.

A second fixed red light, 49 feet above the river level and visible 7⅛ (8½) miles, is shown from a square, white, skeleton tower, pyramidal in shape, 437 feet NE. from the preceding.

Just before changing the course to the range, two buoys should be seen, one on either bow.

Belle Isle (east end) Buoy.—A 25-foot spar buoy, painted red and black in horizontal stripes, is moored in 16 feet of water on the east point of the shoal, off the head of Belle Isle. It is also a mark for the division of the channel, which is divided into two parts by Belle Isle.

This buoy should be made a little on the starboard bow, and on the port bow the

Isle aux Peches Buoy, No. 8.—A 25-foot spar buoy, painted red, is moored in 16 feet of water on the edge of the shoal, extending from the west end of the Isle aux Peches.

The range course SW. (S. 45° W.), with the lights in line astern, can be kept until Belle Isle light is passed.

Belle Isle Light.—A fixed red light, 42 feet above the river level and visible $11\frac{3}{10}$ (13) miles, is shown from a square tower on a dwelling, both being built of red brick. It is on the SE. point of Belle Isle.

From here a mid-channel course can be kept until close to Fighting Island.

NORTHERN CHANNEL.

A vessel standing into the Detroit River and intending to take this channel should change course, when Windmill Point light is abeam, to W. $\frac{3}{8}$ S. (S. 85° 47′ W.), which will carry, in deep water, until close to the

Scott Middle Ground (upper end) Buoys.—No. 6 is a 16-foot spar buoy, painted red, moored in 18 feet of water on the north point of this middle ground.

A mid-channel course should be kept past buoys Nos. 4 and 2.

No. 4 is a 16-foot spar buoy, moored in 24 feet of water on the NW. point of the middle ground.

No. 2 is a 16-foot spar buoy, moored in 11 feet of water just above the Belle Isle bridge.

Passing through the passage in this bridge a course close to the Detroit side will carry, in deep water, past the

Belle Isle (west end) Buoy.—A 25-foot spar buoy, painted red and black in horizontal stripes, is moored in 13 feet of water on the end of the shoal extending to the southeastward from Belle Isle. A mid-channel course can be held to near Fighting Island. When one mile south of the coal chutes, which will be one mile north of Fighting Island, the course should be gradually changed to the southwestward, keeping Fighting Island to port.

MAIN CHANNEL—CONTINUED.

Continue a mid-channel course between Fighting Island and Grassy Island until on the

Ecorse Range.—Two fixed red lights, each shown from a square structure, with a white pyramidal tower surmounted by an octagonal lantern and surrounded by a balcony with a black hand rail.

The front tower stands on a platform supported on piles, in $3\frac{1}{2}$ feet of water, about 150 feet from the 18-foot curve. The rear tower, in $2\frac{1}{2}$ feet of water, is in the marsh about 550 feet N. 1° 42′ W. from the front tower

Each light illuminates 135° of the horizon lying between S. 69° 12′ E., and S. 65° 48′ W., or 67½° to the eastward and to the westward of the range. These lights form a range for running the main channel of the Detroit River and intersect the Mamajuda range at a point about 950 feet to the eastward of

Grassy Island Light.—A fixed white light, varied by a white flash every minute and visible 11 9/10 (13¾) miles, is exhibited from a lantern surmounting a square, cream-colored tower attached to a dwelling built on submerged piles and surrounded by a cofferdam. It stands in 5 feet of water.

From here a course of S. ¾ W. (S. 8° 26′ W.) will carry, on the Mamajuda range, to a point about ¾ mile from the red light.

Mamajuda Range Light.—A fixed red light, on Mamajuda Shoal, in 3½ feet of water, is shown from a square, white, pyramidal tower on a platform supported by piles. It is 28 feet above the river level and 600 feet N. ¾ E. (N. 8° 26′ E.) from Mamajuda light.

This light illuminates an arc of 120°, between W. ¾ N. (N. 81° 33′ W.) to S. by E. ⅞ E. (S. 21° 05′ E.).

With Mamajuda light as a rear light, it forms a range marking the best water from a point 950 feet eastward of Grassy Island light to a point ¾ mile from this red light.

From this point a course of south should be made until abeam of Mamajuda light or on Gross Isle, upper range.

Mamajuda Light.—A fixed red light, visible 11 3/10 (13) miles, is exhibited from a low, square tower on a white dwelling built on piles. The tower is connected with the islet by a short footbridge. It stands in 3 feet of water 200 feet from the edge of the channel.

The range formed by this light with Grassy Point light can be used north of Grassy Point south of Mamajuda, or between the two, care being taken not to approach Mamajuda on the south nearer than 500 yards nor on the north nearer than 1,100 yards. Nor should it be carried nearer to Grassy Point than 900 yards.

When abeam of Mamajuda light, or, if possible, sooner, shape a course on the upper range of Grosse Isle, S. by W. ⅛ W. (S. 12° 39′ W.).

Grosse Isle, Upper Range.—Two fixed white lights, each shown from a square, brown, pyramidal framework tower, with a small white house with a red roof at its base.

The front light is 45 feet above the river level in 3½ feet of water.

The rear light is 75 feet above the river level, 450 feet from the shore, and about 1,350 feet S. by W. ⅛ W. (S. 12° 39′ W.) from the front light.

Each light illuminates 90° of the horizon between WSW. ⅜ W. (S. 71° 43′ W.) and S. by E. ⅜ E. (S. 18° 16′ E.).

This range marks the best water from a point 750 feet eastward of Mamajuda light to the intersection with the Grosse Isle, lower range, up the river.

Keep the course until the lower range is made, when change course to S. by E. $\frac{5}{8}$ E. (S. 18° 16′ E.) with the lights in line astern.

Grosse Isle, Lower Range.—The front light is a fixed white lens lantern, 30 feet above the river level and shown from a square, white, pyramidal tower, surmounted by an octagonal lantern. This is built on a crib about 3,000 feet S. 36° W. of Mamajuda lighthouse.

The rear light, about 1,493 feet N. by W. $\frac{1}{2}$ W. (N. 16° 52′ W.) from the preceding, is a fixed white light shown from a tower similar to the front light tower and 50 feet above the river level.

The course S. by E. $\frac{5}{8}$ E. (S. 18° 16′ E.) will carry through about 17 feet of water until the Limekiln Crossing Range (Canadian) can be made, passing on the way:

A Red Spar Buoy, in 9$\frac{1}{2}$ feet of water on the east side of the channel, which marks the edge of the bank at the lower end of Fighting Island:

A Black Stake Buoy.—A 25-foot spar buoy, standing in a sandy bottom at the elbow of the flat and about 1,000 feet N. 25° W. from

Ballards Reef Lightboat, a small flat-bottom scow, with a trunk cabin, painted red, with name in white letters on each side. It shows a fixed red light visible 5 (5$\frac{3}{4}$) miles. The boat is moored off the easterly end of Ballards Reef in 18 feet of water:

Fog Signal.—During thick and foggy weather a bell will be struck by hand.

A Red Spar Buoy, on the 3-fathom curve of the bank SW. from the mouth of the aux Canards River.

The bed of this range was swept with a horizontal bar suspended from a flatboat and numerous bowlders were found with but 17 to 18 feet of water over them. These bowlders are dangerously near the range, consequently no passage can be described for a 20-foot ship until a further survey is made. The passage through this portion of the river can be made by vessels drawing not over 17 feet, but as it is probable that these bowlders are scattered over the entire bed of this section of the river great caution must be observed.

A Red Can Buoy off Dougalls rock.

The course S. 18° 16′ E. can be carried for nearly 3$\frac{1}{2}$ (4) miles until abeam of the

Limekiln Crossing (North) Lightvessel, No. 65.—A small flat-bottom scow, with a trunk cabin, painted white, with name in red letters on each side. From it is shown a fixed white light visible 5 (5$\frac{3}{4}$) miles. It is moored on the easterly side of the north end of the cut at Limekiln Crossing but on the west side of the passage through on the

Limekiln Crossing Range (Canadian).—The front light of this range is on a pier on the shoal off Fort Malden, above Amherstburg. It is a fixed white light, 31 feet above the river level and visible 2 (2¼) miles. It is shown from a white skeleton tower surmounted by a metal lantern.

The rear light is fixed red, visible 2 (2¼) miles, and 51 feet above the river level, shown from a red skeleton tower surmounted by a metal lantern. The tower is on a pier 890 feet S. $\frac{1}{10}$ E. (S. 1° 07′ E.) from the front light.

While heading down to the Limekiln Crossing range a range on the Canadian side will be seen. This range is private, belonging to Duff and Gatfield and is nearly on the alignment of the Grosse Isle lower range, the points of intersection with the Limekiln Crossing range differing about 600 feet.

When on Limekiln Crossing range head through the cut, a distance of 2,500 feet until abeam of the South Limekiln Crossing lightvessel.

This cut is 440 feet wide, the Canadian range leading through the center of it.

There is a private range on Texas dock, which also leads through the cut a little east of the Government range.

Limekiln Crossing (South) Lightvessel, No. 64, is similar in all respects to No. 65, except that it is moored on the south end of the cut.

When abeam of this lightvessel the Bois Blanc Island range should be seen.

Head of Bois Blanc Island Range (Canadian).—The front light, 300 feet from the extreme north point of the island, is fixed white, visible 2 (2¼) miles and shown from a white tripod with an oval target on top. It is 70 feet above the river level.

The rear light, 150 yards S. by W. ½ W. (S. 16° 52′ W.) from the front light, is fixed red, visible, 2 (2¼) miles and shown from a red tripod with an oval target on top. It is 90 feet above the river level.

Head on this range and so continue until abeam of

A Red Can Buoy on the Canadian side, or on a range of private lights, close to the buoy.

An obstruction has been found 775 yards SE. ⅛ E. (S. 47° E.) of Bois Blanc range, rear light.

A near mid-channel course should now be kept until the Amherstburg range is made. It is preferable to keep on the Bois Blanc Island side to clear

A Red Spar Buoy marking the New York bowlders.

After passing this buoy a

Black Spar Buoy will be passed abreast of the lumber dock and when abeam of Bois Blanc lighthouse another black stake buoy should be seen, both on the Bois Blanc side.

Amherstburg Range is maintained by the Lake Carriers' Association of Buffalo, N. Y.

The front light is fixed red, visible 8 (9¼) miles and shown from a square, white tower, 56 feet above the river level. The tower is 80 feet from the water and 2,300 feet north of Frasers dock.

The rear light is fixed red, visible 8 (9¼) miles and shown from a square, red tower, 80 feet above the river level. It is 475 feet N. by E. ⅜ E. easterly (N. 16° 30′ E.) from the front light.

Stand down the river with the range in line astern heading S. 16° 30′ W. passing

Bois Blanc Light.—A fixed white light, visible 14 (16⅛) miles, is on the south end of Bois Blanc Island. It is shown from a circular white tower with a dwelling on the east side. The lantern is red.

Below Bois Blanc light, the following buoys will be passed:

A Black Can Buoy, about 1,400 feet S. 5° W. from Bois Blanc light.

A Black Can Buoy, about 4,000 feet S. 16° W. from Bois Blanc light.

Opposite this buoy and 1,200 feet S. 75° E. from it is

A Red Can Buoy, and 3,900 feet S. 19° W. from this buoy is

A Shoal (Pontiac) with 15½ feet over it, hard bottom. It is on the Amherstburg range. This shoal should be kept to the eastward for better water. Resume the range after passing the shoal, which will carry in deep water to the black buoy close to the Bar Point lightvessel, passing on the way

A Red Can Buoy, 3,700 feet S. 6° W. from Pontiac Shoal.

A Red Spar Buoy, 1,400 feet S. 60° E. from Bar Point lightvessel.

A Black Spar Buoy, 500 feet S. 60° E. from Bar Point lightvessel.

Pass this buoy close-to keeping it to starboard and change course to S. by W. ¾ W. westerly (S. 20° W.) which will carry past the following:

Bar Point Lightvessel, No. 59, is moored in 17 feet of water off Bar Point Shoal. It is schooner-rigged, two masts, no bowsprit. The light is fixed white, shown from three lanterns encircling the fore masthead. It is visible 11 7/10 (13½) miles. There is a circular black cage-work day mark at the fore masthead and a small black smokestack and fog signal between the masts. The hull is black with "No. 59, Bar Point Shoal" in white letters on each side.

Fog Signal.—A 6-inch steam whistle sounds a blast of 10 seconds every 30 seconds. If the whistle be disabled a bell will be rung by hand.

A Black Spar Buoy, about 1,550 feet S. 10° W. from the lightvessel.

A Black Spar Buoy, about 3,350 feet S. 17° W. from the lightvessel.

On the port hand should be seen

A Red Spar Buoy, about 1,500 feet N. 60° E. from the last black buoy.

A Red Spar Buoy, about 4,100 feet S. 4° W. from the latter.

A Red Spar Buoy, about 5,800 feet S. 32° E. from the last.

When clear of the last black buoy a course can be shaped into Lake Erie.

When the deep-water channel is finished, run down on the Amherstburg range until Bois Blanc light bears N. ⅞ E. easterly (N. 10° 30′ E.) when a course S. 10° W. will, with Bois Blanc light astern and Bar Point light ahead, carry to and through the channel and on to Bar Point light, which can be passed on either hand.

LAKE ST. CLAIR.

Lake St. Clair is of irregular shape, being 8¼ miles wide and 26½ miles long from New Baltimore on the north to Belle River on the south. Anchor Bay, the northwestern section of the lake is cut off by a bar with a least depth of 8 feet over it at the center. This bar extends across from the mouth of the Clinton River to the mouth of the Chenal Aboutrond.

New Baltimore and Fairhaven are on the north shore of the bay, the former having 8 feet and the latter 6 feet off the ends of the wharves.

Ten miles south of New Baltimore is Point Huron with shoal water off it. From here to Milk River Point there is but 12 feet of water 1¼ miles from shore. From here to Windmill Point, vessels drawing 12 feet should not approach the shore nearer than ⅝ mile. On the south shore Belle River Station is the only town of any size between the Detroit River and the Thames River. The 12-foot curve is from one mile to 2⅛ miles off this coast.

The Thames at the SE. end of this lake is the only river of any importance on the Canadian side, and at its mouth are range lights.

Thames River Lights.—A fixed white light, visible 12 (13⅞) miles, is shown from a circular, white tower. It is on the south shore of the mouth of the river.

A fixed white light, visible 6 (7) miles, is shown from a square, red tower. It is 300 feet NW. ½ N. (N. 39° 22′ W.) from the main light. These two lights in one lead over the bar. This bar has a least depth of 7 feet.

From the Thames River the coast trends nearly north to Mitchel Point and north and west of the point is Mitchel Bay.

From the east shore the 12-foot curve averages the same distance as it does from the south shore.

The north shore from Mitchel Point to the United States Ship Canal is low and marshy, with shoal water extending off over 2 miles.

The course from the mouth of the ship canal to the bar of the Thames River is SE.

The middle of this lake has an average depth of 3½ fathoms, mud and clay.

Anchor Bay can be approached through the north channel, but it has a bar of 8 feet least water at its mouth.

CHAPTER II.

LAKE ERIE.

U. S. Lake Survey Charts.

Lake Erie is the most southern of the Great Lakes. The State of Michigan bounds its western shore, and Ohio, Pennsylvania and New York its southern and southeastern shores. The Province of Ontario, Canada, bounds the northern shore.

The lake lies between 41° 20′ and 42° 55′ N., and between 78° 55′ and 83° 30′ W. It is nearly elliptical, the major axis (217 (250) miles in length) lying east and west. Its greatest breadth north and south is 52 (60) miles; its circumference 573 (660) miles, and its area about 10,000 square miles. Its elevation above the sea level is 572.86 feet, and its surface is 326.25 feet above that of Lake Ontario; this great descent being taken up by the Niagara River and Falls, which connect the two lakes at the eastern end, its western end being connected with Lake Huron by the Detroit River and St. Clair Lake and River.

There are four important canal systems which connect with this lake: The Erie Canal, extending from Buffalo, N. Y., to the Hudson River; the Miami and Erie Canal, from Toledo to Cincinnatti, on the Ohio River; the Ohio and Erie Canal, from Cleveland to Portsmouth, on the Ohio River, and the Welland Canal, connecting Lakes Erie and Ontario; this latter being entirely within the Dominion of Canada.

Like Lake Michigan, the coast of Lake Erie is comparatively free from indentations, and, excepting the western end, it is clear of islands.

The shores, of clay and sand, are generally bold and elevated. The most fertile country is some distance from the banks, except at the western end, where the growth is more luxuriant along the beach, which, here, is of fine, white sand.

The peculiar features of Lake Erie are its shallowness and its clayey shores; the depth, excepting east and SE. of Long Point, rarely exceeding 100 feet.

The bed of the lake can be considered as in three divisions, increasing in depth from the Detroit River to the outlet. The western portion, as far as Pointe Pelée Island, has a level bottom with an average depth of 30 feet. The middle portion, taking in the principal part of the lake to Long Point, is also level and from 60 to 70 feet deep. Beyond Long

Point the depths vary from 210 feet, near the Point, to 40 and 30 feet near the eastern shore.

The shallow waters of this lake are easily disturbed by the winds, and, for this reason and the lack of good harbors, it is very dangerous navigation. Long continued storms, with the wind setting along the lake in one direction, pile up the water to leeward with disastrous results. Buffalo has suffered much from this. The return of the waters after a storm is often so rapid (especially if the wind changes with it) as to produce powerful currents. On one occasion the waters burst a passage through Long Point, making it an island.

The bottom is a light, clayey sediment, which rapidly accumulates from the wearing away of the shores.

Along the coast the disintegrating strata are frequently seen forming high cliffs, extending back into elevated plateaus, with rivers cutting channels through them and carrying the excavated matter into the lake. Underground water courses undermine the cliffs and the waves aid in breaking them down. Land slides are of frequent occurrence and render the water turbid a long distance from shore. This may be seen on both sides of the lake. Near Cleveland the recession of the coast line has been particularly remarkable. From here the terrace cliffs (103 feet high at Cleveland) extend 40 miles east to Fairport.

There is an immense commerce on the lake, the Welland Canal being the outlet for it to Lake Ontario.

HARBORS OF REFUGE.

Sandusky, for vessels of 17 feet draft.
Cleveland, for vessels of 19 feet draft.
Erie, for vessels of 17 feet draft.
Buffalo, for vessels of 23 feet draft.
Port Colborne, for small vessels.
Dunkirk, for small vessels.
Mouth of the Detroit River, and possibly
Rondeau Harbor.

ANCHORAGES.

Good anchorage can be found under the lee of Pointe Pelée, also under Long Point; between Middle and South Bass islands, as well as under the lee of other islands.

NAVIGATION.

As a rule, navigation opens in the middle of April and closes the middle of December.

The two great evils to navigation are fogs and snow.

There are no tides and generally but light currents for the master to contend with on the lakes, and as these are the most uncertain of all elements for the navigator to calculate and allow for, it reduces very much

the percentage of danger in lake navigation; hence, the safe navigation of the lakes is confined to a correct compass, with a knowledge and frequent use on the part of the master of the azimuth tables; the precaution to take cross bearings of prominent points and from them plotting the position frequently on the chart; also, the familiar use of the chart in laying courses and correcting the same for variation and deviation.

DANGERS.

East of the Meridian of Pointe Pelée, the lake is remarkably free from outlying dangers, Seneca and Waverly shoals at the extreme eastern end, and a reef westward of Port Maitland on the north shore, being the only ones well off shore. The northern shore of the lake has not been thoroughly surveyed and there may exist some unknown offlying dangers, but the coast is generally steep-to.

West of the Meridian of Pointe Pelée, the water is shallow, with many islands, between and around which are shoals. West of the islands are several shoals. From the western and southern shores of the lake in this locality, shoal water extends out some distance. All of these dangers are described under the islands and shores of the lake.

Southeast Shoal has recently developed $2\frac{9}{10}$ ($3\frac{1}{3}$) miles SE. $\frac{3}{8}$ S. (S. 40° 46′ E.) of the Dummy light. It has probably been formed by vessels grounding and dumping ballast overboard. This locality, especially to the westward of Pointe Pelée, should be navigated with caution on account of shoal water, and the various wrecks that have occurred.

ROUTES.

It is best to stand down the Detroit River passing to the eastward of the lighthouse and taking departure from a point $\frac{1}{2}$ mile SE. of Detroit River (Bar Point) light.

Detroit River to Monroe.—From point of departure off Detroit River lighthouse steer south for 2 ($2\frac{1}{4}$) miles, then SW. by W. $\frac{3}{8}$ W. (S. 60° 28′ W.) for $8\frac{3}{8}$ (10) miles and run in under special directions.

Detroit River to Toledo.—From point of departure off Detroit River lighthouse steer SW. by S. (S. 33° 45′ W.) for $16\frac{3}{4}$ ($19\frac{1}{4}$) miles and run in on the range.

Detroit River to Ports on the South Shore.—From off Detroit River lighthouse steer SSE. $\frac{5}{8}$ E. (S. 29° 31′ E.) for $25\frac{1}{4}$ (29) miles, which will take a vessel one mile south of Green Island. When Green Island lighthouse bears north change course to SE. by E. $\frac{1}{8}$ E. (S. 57° 39′ E.); continue this course for $8\frac{3}{4}$ ($10\frac{1}{4}$) miles until Marblehead lighthouse is abeam, distant one ($1\frac{1}{4}$) mile (a point of departure for the following ports).

Note.—The course SE. by E. $\frac{1}{8}$ E. (S. 57° 39′ E.) passes between the red nun buoy (Starve Island reef on the north) and the black can buoy

(Mouse Island reef on the south), and close to a black can buoy on Scott Point shoal. This latter buoy must be left to starboard.

The range of Green Island and Marblehead lights, SE. $\frac{1}{8}$ E. (S. 46° 24′ E.) leads between the shoals passing over the edge of an 18-foot shoal to the eastward of Scott Point shoal.

To Sandusky.—From point of departure off Marblehead lighthouse a SSE. $\frac{1}{8}$ E. (S. 23° 54′ E.) course for $3\frac{1}{8}$ ($3\frac{3}{8}$) miles will take a vessel off the entrance to Sandusky Bay. See special directions for entering.

To Huron.—From point of departure a SE. $\frac{3}{8}$ S. (S. 40° 46′ E.) course for 11 ($12\frac{1}{4}$) miles will take a vessel off Huron Island lighthouse. See special directions for entering.

To Vermillion.—From point of departure a SE. by E. $\frac{1}{8}$ E. (S. 66° 05′ E.) course for $16\frac{1}{2}$ (19) miles will take a vessel off Vermillion lighthouse. See special directions for entering.

To Lorain.—From point of departure an E. $\frac{1}{8}$ S. (S. 80° 09′ E.) course for $23\frac{1}{8}$ ($26\frac{1}{8}$) miles will take a vessel off Black River light. See special directions for entering.

To Cleveland.—An E. $\frac{1}{4}$ S. (S. 87° 11′ E.) course for $43\frac{1}{2}$ (50) miles will take a vessel one mile off the Breakwater lights at Cleveland. See special directions for entering.

Or, a vessel can take the route by way of Pointe Pelée, which see.

Detroit River to Buffalo and ports on south shore of the lake, to Cleveland and eastward.—From a mile north of Colchester Reef light abeam (see page 51) an ESE. $\frac{3}{8}$ E. (S. 71° 43′ E.) course for $14\frac{1}{10}$ ($16\frac{1}{4}$) miles should take a vessel to a point with Pelée Island light bearing SW. and the Dummy light east. Here change course to SE. $\frac{3}{4}$ E. (S. 53° 26′ E.) for 7 (8) miles when the Dummy should bear NNW. $\frac{1}{2}$ W. (N. 28° 07′ W.) distant $4\frac{3}{4}$ ($5\frac{1}{2}$) miles, the point of departure for all ports on the lake. Or, with the wind fresh from the southward an ESE. (S. 67° 30′ E.) course from off Detroit River (Bar Point) lightvessel for $11\frac{1}{4}$ (13) miles will take a vessel a mile south of Colchester Reef light abeam. Here shape course ESE. $\frac{1}{8}$ E. (S. 77° 20′ E.) for $14\frac{1}{3}$ ($16\frac{1}{2}$) miles to the point designated above NE. of Pelée Island light and west of the Dummy.

To Buffalo.—From off Pelée Spit lighthouse, an ENE. $\frac{1}{8}$ E. (N. 68° 54′ E.) course for $115\frac{1}{2}$ (133) miles will take a vessel $1\frac{3}{4}$ (2) miles south of Long Point lighthouse, when change course to ENE. (N. 67° 30′ E.) for 54 ($62\frac{1}{4}$) miles, this will take a vessel off Buffalo breakwater, passing northward of Waverly shoal and buoy. See special directions for entering.

COURSE AND DISTANCE FROM OFF PELÉE SPIT LIGHTHOUSE.

To Cleveland.—SE. by E. $\frac{5}{8}$ E. (S. 63° 17′ E.) for $36\frac{1}{2}$ (42) miles.

To Fairport.—E. $\frac{1}{8}$ S. (S. 88° 35′ E.) for 53 (61) miles.

To Ashtabula.—E. $\frac{1}{2}$ N. (N. 84° 23′ E.) for $74\frac{3}{8}$ (86) miles.

To Conneaut.—E. $\frac{5}{8}$ N. (N. 82° 58′ E.) for $85\frac{3}{4}$ ($98\frac{3}{4}$) miles.

To Erie.—ENE. $\frac{7}{8}$ E. (N. 77° 21′ E.) for $107\frac{9}{10}$ ($124\frac{1}{4}$) miles, off Presque Isle light.

To Dunkirk.—ENE. $\frac{1}{2}$ E. (N. 73° 07′ E.) for $144\frac{6}{10}$ ($166\frac{1}{2}$) miles.

These courses will take a vessel off the port, when special directions under the respective ports should be consulted.

CHAPTER III.

ISLANDS IN THE WESTERN PART OF LAKE ERIE.

The principal islands belonging to the United States are West Sister Island, The Bass islands, Rattlesnake and Green islands, and Kelley Island.

The principal islands belonging to Canada are Middle Sister, East Sister, The Chickens, Middle Island, and Pointe Pelée Island.

UNITED STATES ISLANDS.

West Sister Island.—This, the most western island, lies (the light-house) $13\frac{7}{8}$ (16) miles east of Grassy Point and $7\frac{1}{4}$ ($8\frac{1}{3}$) miles north of Locust Point. It is $\frac{5}{8}$ mile long NE. and SW. and $\frac{1}{2}$ mile north and south and steep-to except on its SE. point, from which a rocky, narrow spit extends SE. $\frac{1}{8}$ mile with 3 feet at its extremity.

Light.—On the SW. point of West Sister Island, from a conical white tower, is shown, 57 feet above the lake level, a fixed white light visible 13 (15) miles. It is obscured on the NE. side of the island by trees through an arc of $1\frac{1}{2}$ points.

A red light, shown at this station in place of the white light, is a signal of distress.

Niagara Reef, with least depth of 7 feet, is $\frac{3}{4}$ mile long east and west and $\frac{1}{2}$ mile north and south. It lies near the track of vessels from West Sister Island to Green Island, but it is marked by a buoy and can be easily avoided.

Buoy.—A black can buoy is moored in 14 feet water on the NE. side of the reef.

The Bass Islands, three in number, with small outlying islands and shoals, occupy a space of 6 (7) miles north and south by $4\frac{1}{3}$ (5) miles east and west. The various channels through these islands, although deep, should not be attempted by strangers, as there are many unmarked shoals and no directions can be given for clearing them.

North Bass Island is about a mile long north and south and nearly the same distance broad; its southern face, however, is $1\frac{1}{2}$ ($1\frac{5}{8}$) miles broad, being widened by narrow peninsulas from the SW. and SE. points of the island. Shoals extend out one ($1\frac{1}{4}$) mile along its western side. Shoals extend $\frac{3}{8}$ mile off at other points.

The channel between North and Middle Bass carries from 3¼ to 6 fathoms, but there is a detached 16-foot spot south of mid-channel and nearer to Middle Bass.

Middle Bass Island lies a mile south of North Bass (the shores of these islands are nearly parallel east and west). The island is 1¼ (1½) miles long north and south and somewhat narrower than North Bass. The NE. point extends eastward from the island as a narrow peninsula for 1⅛ (1¼) miles. From the east point of this peninsula to the west point of Sugar Island (which is nearly ½ mile east and west, and connected to Middle Bass by shoals) the south shore of the channel is 2⅛ (2¾) miles long. Shoals extend ½ mile eastward from the end of the peninsula. In the bight south of the peninsula the west shore of the island can be approached to a 4-fathom depth, and this bight affords excellent anchorage and protection from westerly and northerly winds. The island can generally be approached to ¼ mile excepting off the points, which should be given a wider berth.

The channel between Middle and South Bass islands runs east and west, and after passing the SE. point of Middle Bass bends to the NE. and around the north side of Ballast Island. This channel carries 3½ to 6 feet water. There is no passage except for light-draft vessels between Ballast Island and South Bass.

Ballast Island, a small circular island, steep-to on its northern face, is connected to South Bass Island by shoals through which, and nearer Ballast Island, is a narrow channel with 14 feet water.

Buoys.—A black spar buoy is moored in 15 feet of water, rocky bottom, at the south side of the eastern entrance to this channel. The south side of the channel extends 650 yards WNW. from this buoy.

A black spar buoy is moored in 16 feet of water at the inner end of the channel.

Rattlesnake Island lies a mile west of the western point of Middle Bass. It is ¾ mile long NW. and SE. Shoals extend ¼ mile off its NW. point. A small detached rock lies nearly at the end of the shoal water. The rest of the island is steep-to.

South Bass Island, the largest of the group, is south of Middle Bass. Its SE. shore is 3 (3½) miles long, while the NW. coast is but one (1¼) mile. On the north coast is Put in Bay. Its SW. face is steep-to and affords anchorage and protection from easterly and northeasterly winds. Shoals line the whole SE. coast and from the SE. point extend over ½ mile to Starve Island, and some distance beyond. Beyond this shoal is a small detached spot with 11 feet over it.

Put in Bay, in the north coast of the island is ¾ mile wide and ⅜ mile deep. Gibraltar Island lies in the western part of the bay. The whole western part of the bay and the eastern side for some distance is shoal, but

snug anchorage can be obtained in 3½ to 5 fathoms, protected from all winds from the east, south, and SW. Port Orchard Point is the west point of the bay.

Port Orchard Point Buoy, a red spar buoy, is moored in 12 feet of water and marks the elbow of a rocky shoal extending 375 yards NE. from the point and thence 170 yards toward Gibraltar Island. The western edge of the shoal lies 140 yards outside the point.

Starve Island Reef, 400 feet in diameter, least water 11 feet, lies one mile ENE. of Mouse Island reef. The track of vessels lies between these two shoals. This shoal lies exactly on the range of Green Island lighthouse and the SW. point of South Bass Island. When Green Island lighthouse can be seen open south of South Bass Island vessels are clear of the shoal to the southward. Two-thirds of the way from this reef to Starve Island is a rocky patch with 11 feet of water over it.

Buoy.—A red nun buoy is moored in 14 feet of water on the SW. end of Starve Island reef. Vessels must pass south of this buoy.

Mouse Island Reef, least water 12 feet, lies one (1¼) mile north of Mouse Island.

Buoy.—A black can buoy is moored in 16 feet of water on the NW. end of this reef. The shoalest water on the reef is 150 yards SW. by W. from the buoy. Vessels must pass north of this buoy.

Scott Point Shoal, least water 12 feet, is a rocky shoal on the south of the channel. It is 400 yards wide and from its NW. end stretches toward and halfway to Mouse Island, leaving a channel ½ mile wide between the shoal and the island. SE. of this shoal is an 18-foot patch ½ mile long east and west.

Buoy.—A black can buoy is moored in 16 feet of water on the NE. end of the shoal and lies very close to the track of vessels through the channel. This buoy should be left well to the southward in passing.

Green Island, ¼ mile long east and west, is one (1¼) mile west of the extreme west point of South Bass Island.

Light.—On the west end of Green Island, from a square gray tower, is shown, 60 feet above the lake level, a fixed white light varied by a red flash every minute, visible 13¼ (15¼) miles. The light is obscured between the bearings SW. by W. (S. 56° 15′ W.) and NW. by W. (N. 56° 15′ W.) by the woods on the island.

The range of this with West Sister light NW. by W. ⅝ W. (N. 63° 16′ W.) passes a mile to the northward of Niagara Reef.

The light just open of the SW. point of South Bass Island, passes south of Starve Island reef.

Open westward of the west end of Rattlesnake Island, passes west of the Chicken Island and east of East Sister Island.

Kelley Island, the largest of the United States islands, is $2\frac{7}{8}$ ($3\frac{1}{4}$) miles north of Marblehead light. The island is $1\frac{1}{2}$ ($1\frac{3}{4}$) miles north and south and $2\frac{3}{8}$ (3) miles east and west. The NE. end of the island forms a narrow point a mile long. There are many small open bays on the north and SW. coasts of the island, the latter, in which is a wreck, affords anchorage in north and NE. winds. The north bay affords protection from all southerly winds. The east and SE. shores should not be approached to $\frac{5}{8}$ mile, as shoals extend off in places to nearly that distance. The other part of the island can be approached somewhat nearer.

Kelley Island Reef is 1,500 yards NE. from the NE. point of Kelley Island, with a clear channel between. The reef extends ENE. and WSW. for one ($1\frac{1}{4}$) mile and is 600 yards across its widest part, with least water 6 feet.

Buoy.—A black nun buoy is moored in 16 feet of water on the east end of this reef.

Gull Island Shoal, north point, is one ($1\frac{1}{4}$) mile south of Middle Island lighthouse (Canadian), the international boundary line passing between. The shoal from its north end extends over a mile SW. and from its southern end a spit extends westward $\frac{1}{2}$ mile. There are rocks above water on the south end of this shoal.

Buoy.—A black can buoy is moored in 16 feet, rocky bottom, on the NE. end of the shoal. The water shoals gradually for 1,500 yards SW. of the buoy where the rocks show above water.

CANADIAN ISLANDS.

Middle Sister, the western of the Canadian islands, lies on the 83° meridian, and is $9\frac{1}{2}$ (11) miles south of the Canadian shore of the lake. It is a small rocky island, $\frac{1}{3}$ mile NE. and SW. The island can be approached to $\frac{1}{2}$ mile with safety.

Grecian Shoal, with several small shoals, least water 12 feet, lies a mile south of the pier at Colchester on the north shore of the lake. There is deep water between the shoal and shore.

Colchester Reef, a small patch, least water 8 feet, lies $3\frac{1}{2}$ (4) miles SW. by S. of the pier at Colchester and 3 ($3\frac{1}{2}$) miles off shore. It lies just south of the track of vessels to Pointe Pelée and is marked by a lighthouse.

Light.—Near the SE. end of the reef, from a red lantern on a white hexagonal building, standing on a circular stone pier, is shown, 72 feet above the lake level, a fixed white light visible 14 ($16\frac{1}{8}$) miles.

Fog Signal.—A bell, rung by machinery, gives one stroke every 15 seconds.

North Harbor Island lies $6\frac{1}{8}$ ($7\frac{1}{4}$) miles ESE. $\frac{1}{8}$ E. (S. 77° 20′ E.) of Middle Sister Island. The island is a rock in the middle of a shoal $\frac{1}{8}$ mile in diameter.

Shoal.—One ($1\frac{1}{4}$) mile north of North Harbor Island is the SE. end of a shoal which extends $\frac{3}{8}$ mile NE. It is $\frac{1}{4}$ mile broad. Two feet least water is on this shoal. A wreck lies near the center of the shoal.

East Sister Island, $\frac{3}{4}$ mile south of North Harbor Island, is $\frac{3}{8}$ mile east and west and on a shoal $\frac{1}{2}$ mile wide, which extends over a mile in the same direction.

Shoals.—Between $\frac{1}{2}$ and $\frac{3}{4}$ mile NE. of the east point of East Sister are detached shoals of 18 and 7 feet least water, the latter shoal is the farthest out and is $\frac{1}{8}$ mile long ENE. and WSW.

Hen Island is $2\frac{7}{8}$ ($3\frac{1}{4}$) miles SE. by E. of the east end of East Sister. It is a small circular island in a shoal extending $\frac{1}{2}$ mile east and west and $\frac{1}{4}$ mile north and south.

Big Chicken Island is $1\frac{1}{4}$ ($1\frac{1}{2}$) miles SW. of Hen Island. It lies on the SW. end of a rocky reef extending $\frac{3}{4}$ mile NE. from the island. Its average breadth is also $\frac{3}{4}$ mile. North of the center of this reef are dry rocks.

Little Chicken Island is $1\frac{1}{8}$ ($1\frac{1}{8}$) miles east of Big Chicken Island. It lies toward the southern edge of a rocky reef with least water 5 feet, near the northern point of the reef. The reef has a breadth of about $\frac{1}{8}$ mile and extends $\frac{1}{2}$ mile NW. and $\frac{1}{8}$ mile east from the island. There are $3\frac{1}{2}$ fathoms water between the Chicken reefs, but the passage should never be attempted.

Pointe Pelée Island, the largest of all the islands in Lake Erie is (north point) $6\frac{1}{8}$ ($7\frac{1}{4}$) miles WSW. of Pelée Spit light (the Dummy). The island is rectangular in shape, with an average length of $4\frac{3}{4}$ ($5\frac{1}{2}$) miles and a breadth of 3 ($3\frac{1}{2}$) miles. Sheridan point is the NW. point of the island, and between this and Lighthouse Point is a bay, which affords anchorage and shelter from southerly and easterly winds. Vessels should not shoal under 4 fathoms. Mosquito Point, the SW. point of the island, extends to the southward for $1\frac{1}{2}$ ($1\frac{3}{4}$) miles as a narrow spit. Mill Point is the SE. end of the island, and off this point is a detached shoal extending east and west $1\frac{1}{2}$ ($1\frac{3}{4}$) miles with a breadth of $\frac{1}{8}$ mile. There is a least depth of 13 feet on this shoal. Middle Point is between Mill and Lighthouse points. Shoals extend a mile northward from Lighthouse Point and also line the whole east coast of the island. One mile SE. of Middle Point is a 17-foot spot. The northern half of the west coast of the island is bold. Shoals extend off the southern half for about $\frac{1}{4}$ mile, with two outlying 18-foot spots, the outer one $\frac{3}{4}$ mile off shore. The southern point of the island has a shoal spit extending from it $\frac{1}{2}$ mile south, and from the east side of this point shoals extend in places to the distance of a mile.

Chickenolee Reef, an extension of this shoal to the eastward for nearly 2 (2¼) miles, has only 4 feet of water in the center. Between Chickenolee Reef and Mill Point Reef, and the shore of the island is a bay, which affords protection from westerly and northerly winds. There is, however, a 17-foot spot and an 18-foot spot in the middle of the entrance to the bay. Between the south spit point and Middle Island are several detached shoals, least water 10 feet, and no vessel should attempt this passage.

Light.—On Lighthouse Point, from a white, circular lighthouse, is shown, 45 feet above the lake level, a fixed white light, visible 9 (10⅓) miles.

Middle Island, 1¾ (2) miles south of the south point of Pointe Pelée Island, is ¾ mile east and west and ½ mile broad. It lies north of Gull Island Shoal and the international boundary line is south of it. The island is steep-to.

Light.—On the east point of Middle Island, from a white, square lighthouse, is shown, 70 feet above the lake level, a fixed red light, visible 12 (13¾) miles.

Fog Signal.—A hand horn answers signals from vessels.

Middle Ground.—Lying almost midway between Pointe Pelée Island and Pelée Spit lights is a most dangerous unmarked shoal. It is just off the track of vessels bound to Pointe Pelée from the west and SW. It is a mile long north and south and ½ mile wide. Least water 11 feet at lowest lake level. A WSW. and ENE. range of Pointe Pelée Island and Pelée Spit lighthouses passes over the center of the shoal. Midway between the Middle Ground and Pointe Pelée Island is a 16-foot patch.

Clearing Marks.—By keeping Lighthouse Point light nothing west of SW. by W. (S. 56° 15′ W.) and Pelée Spit light nothing north of E. by N. (N. 78° 45′ E.) a vessel will pass to the northward of the shoal.

Grubb Reef consists of several 12 and 16 foot rocky patches, lying 2 and 3 miles WNW. of Pelée Spit lighthouse. The reef has extended a mile to the eastward, with a lest depth of 16 feet. This lighthouse bearing east leads clear to the southward of these shoals.

Pointe Pelée and shoals are described in Chapter V.

CHAPTER IV.

UNITED STATES COAST OF LAKE ERIE.

Mouth of the Detroit River to Maumee Bay.—The west coast of the lake from Pointe Mouillée, the west entrance point of the Detroit River, to Grassy Point, the west entrance point of the Maumee Bay, has a general SW. direction. All this portion of the coast has flats extending off it for some distance. Several rivers and creeks empty into the lake and the shore is generally low and marshy. The 3-fathom line is $1\frac{3}{4}$ (2) miles SE. of Pointe Mouillée, but at Stony Point it approaches the shore to $\frac{1}{4}$ mile. To the west of Stony Point is a bight filled with flats, in which is the village of Brest.

Three and a half (4) miles SSW. of Brest is the Raisin River, at the mouth of which is Monroe Harbor.

Monroe Harbor is a part of the Raisin River about $2\frac{2}{10}$ ($2\frac{1}{2}$) miles above the dredged channel which forms the outlet into the lake. The mouth is protected by two piers. The channel is 4,000 feet long and 100 feet wide. At present the depth of water over the bar and throughout the greater part of the channel to the wharves is about 9 feet.

Reports state that it is impossible to charter a vessel drawing over 7 feet for Monroe.

Monroe Light, on a crib at the outer end of the north pier of the entrance to the channel leading into the Raisin River, from a square tower on a white dwelling, is shown a fixed red light, $46\frac{1}{2}$ feet above the lake level, and visible $11\frac{1}{4}$ (13) miles.

Directions.—The best water is found by standing in, in line with the straight (inner) section of the north pier WNW. $\frac{1}{8}$ W. (N. 68° 64′ W).

Caution.—Southwest gales lower the water at the west end of the lake from 2 to 3 feet, and NE. gales raise it the same amount.

South of Monroe the flats extend farther from the shore, and almost fill that portion of the lake west of the meridian of Monroe light and Cedar Point. Strangers should not enter this area except on the ranges and in the axis of the channels.

Maumee Bay, between Grassy and Cedar points, is filled with flats. Maumee River empties into it, and a short distance within the mouth of the river is the city of Toledo.

Depths in the Channel.—May, 1895, depth in the New Straight Channel from the river to deep water of Lake Erie, marked by buoys and range lights, 17 feet on axis and ranging from 16 to 20 feet on the sides of channel.

Buoys.—A black can buoy marks the SE. side of the entrance to Straight Channel, Maumee Bay, and a red nun buoy marks the NW. side of the entrance. The channel in is marked by black spar buoys to port and red spar buoys to starboard in entering. A red spar buoy is moored in 15 feet of water on the NW. bank of the channel opposite the middle of the pile work to show the extreme width of the channel.

LIGHTS.

Turtle Island.—On Turtle Island at the entrance to the bay, from a square, yellow tower, attached to a dwelling, a fixed white light, visible $12\frac{1}{2}$ ($14\frac{1}{4}$) miles, is exhibited 50 feet above the lake level. The light bearing S. by E. (S. 11° 15′ E.) is obscured by the chimney to the dwelling.

MAUMEE BAY RANGE.

Main Beacon.—On the south bank, from a white dwelling on a crib, at the elbow of South and Long reaches, a fixed white light is exhibited $27\frac{1}{4}$ feet above the lake level.

East Beacon.—At 1,000 feet northeastward of the Main beacon, from a brown shaft on a crib, is shown a fixed white light 42 feet above the lake level. This light shows up the dredged channel to the southwestward, and also in the direction of the outer end of the New Straight Channel over an arc of 50° between the bearings SSW. $\frac{7}{8}$ W. (S. 32° 20′ W.) and W. $\frac{5}{8}$ S. (S. 82° 58′ W.), the entrance to the channel lying about midway between, or on the bearing S. 58° 15′ W.

South Beacon.—At 1,000 feet to the southward of the Main beacon, from a brown shaft on a crib, is shown a fixed white light 43 feet above the lake level.

These lights form the following ranges:

Main Beacon and South Beacon Lights.—Range for the Old Channel from Turtle Island to the New Straight Channel.

Main Beacon and East Beacon Lights.—Range (back) for inner part of the Straight Channel.

East Beacon and Main Beacon Lights.—Range for the outer part of the New Straight Channel from the lake.

MANHATTAN RANGE LIGHTS.

Front.—The front beacon stands on a platform 8 feet above the water on a substructure of red iron piles in 3 feet of water $4\frac{1}{4}$ ($4\frac{5}{6}$) SW. by

W. ⅛ W. westerly (S. 58° 15′ W.) from the front light of Maumee Bay ranges. The light is fixed red and 28 feet above the lake level.

Rear.—The rear beacon is a skeleton structure, except the section immediately below the lantern is inclosed, and is 3,470 feet SW. by W. ⅛ W. westerly (S. 58° 15′ W.) from the front beacon. The light is fixed red and 53 feet above the lake level.

Each beacon is a square, white, pyramidal structure with green window shutters, and is surmounted by an octagonal lantern with red roof. Each light is visible from (ESE. ⅛ E.) S. 77° 15′ E. through south, west and north to (N. by E. ⅛ E.) N. 12° 45′ E., or 135° to the northward and 135° to the southward of the range.

Directions.—The entrance of the channel is 2⅛ (2½) miles E. ¼ N. (N. 87° 11′ E.) of Turtle Island light, and is marked by a black can and a red nun buoy. Keep in over 3 fathoms of water until the buoys are picked up or the beacons (East and Main) come in range S. 58° 15′ W. Stand in on the range until up to buoy No. 14, then haul a little to the westward to pass the cribs and pile work. When up to buoy No. 16 bring the Manhattan range on and steer between the buoys until past inner end of Channel Buoy No. 29. From this point steer for the draw of the Wheeling and Lake Erie Railroad bridge, and passing Middle Ground Buoy No. 34, steer for the draw of the Pennsylvania Railroad bridge and to the docks. Seventeen feet can be carried in on these directions.

ROUTES.

Toledo to Sandusky, Huron, Vermillion, Lorain and Cleveland.—When clear of the New Straight Channel bring Turtle Island lighthouse to bear W. ⅛ N. (N. 88° 35′ W.) astern, and shape a course E. ⅛ S. (S. 88° 35′ E.) for 10⅓ (11⅞) miles. This should bring a vessel one mile north of West Sister Island lighthouse, with the lighthouse abeam. Change course to SE. by E. ⅛ E. (S. 57° 39′ E.) and continue it for 22⅛ (25½) miles, which should bring Marblehead lighthouse abeam distant one (1¼) mile, which is the point of departure for the ports mentioned.

This last course will pass a mile north of the buoy on Niagara Reef; a mile south of Green Island lighthouse; between the red nun buoy (Starve Island Reef on the north) and the black can buoy (Mouse Island Reef on the south) and close to a black can buoy on Scott Point Shoal.

This latter buoy *must* be left to starboard.

The range formed by Green Island and Marblehead lights, SE. ⅛ E. (S. 46° 24′ E.) leads between these shoals, but passes over an 18-foot shoal to the eastward of Scott Point Shoal.

To Sandusky.—From the point of departure off Marblehead lighthouse a SSE. ⅛ E. (S. 23° 54′ E.) course for 3⅛ (3⅜) miles will take a

vessel off the entrance to Sandusky Bay. See special directions for entering.

To Huron.—From the point of departure a SE. $\frac{3}{8}$ S. (S. 40° 46′ E.) course for 11 (12$\frac{3}{4}$) miles will take a vessel off Huron Island lighthouse. See special directions for entering.

To Vermillion.—From the point of departure a SE. by E. $\frac{1}{8}$ E. (S. 66° 05′ E.) course for 16$\frac{1}{2}$ (19) miles will take a vessel off Vermillion lighthouse. See special directions for entering.

To Lorain.—From the point of departure an E. $\frac{7}{8}$ S. (S. 80° 09′ E.) course for 23$\frac{1}{8}$ (26$\frac{7}{8}$) miles will take a vessel off Black River lighthouse. See special directions for entering.

To Cleveland.—From the point of departure an E. $\frac{1}{2}$ S. (S. 87° 11′ E.) course for 43$\frac{1}{2}$ (50) miles will take a vessel one mile off the breakwater lights at Cleveland. See special directions for entering.

Or, a vessel may shape her course from West Sister Island lighthouse to Pelée Spit lighthouse (see Toledo to Pelée Spit lighthouse) and then from this last point to Cleveland. See Detroit River to Cleveland.

TOLEDO TO PELÉE SPIT LIGHTHOUSE, BUFFALO, AND PORTS ON THE NORTH AND SOUTHEASTERN SHORES OF THE LAKE.

U. S. Lake Survey Chart No. 75.

When north of West Sister Island lighthouse (see Toledo to Sandusky) change course to ENE. $\frac{5}{8}$ E. (N. 74° 31′ E.) for 12$\frac{4}{10}$ (14$\frac{1}{2}$) miles, when the east point of East Sister should be abeam distant $\frac{3}{4}$ mile. Change course to ENE. $\frac{1}{4}$ E. (N. 70° 18′ E.) for 12$\frac{4}{10}$ (14$\frac{1}{2}$) miles, when the Dummy light should bear east and Pelée Island light SW. (Do not bring the Dummy light anything to the southward of east.) Here change course to SE. $\frac{3}{4}$ E. (S. 53° 26′ E.) for 7 (8) miles, when the Dummy light should bear NNW. $\frac{1}{2}$ W. (N. 28° 07′ W.) distant 4$\frac{3}{4}$ (5$\frac{1}{2}$) miles, which is the point of departure for the other ports in the lake.

For any special port see Detroit River to Pelée Spit lighthouse and port desired, pages 17, 18, and 51.

Cedar Point to Locust Point.—Locust Point is 12$\frac{1}{8}$ (14) miles SE. by E. $\frac{1}{2}$ E. of Cedar Point, the shore between receding slightly from the line joining the points. All this part of the coast is bordered by flats, extending off about 1$\frac{3}{4}$ (2) miles. At Locust Point the flats widen and extend 5$\frac{1}{4}$ (6) miles in the direction of Niagara Reef, leaving a passage of one mile in width between the shoals and reef, but as there are several rocky, detached shoals to the westward of the reef, no vessel should attempt to pass inside of Niagara Reef.

Niagara Reef, with least depth of 7 feet water, is $\frac{3}{4}$ mile long east and west and $\frac{1}{2}$ mile north and south. It lies near the track of vessels from

West Sister Island to Green Island, but it is marked by a buoy and can be easily avoided.

Buoy.—A black can buoy is moored in 14 feet of water on the NE. side of the reef.

Locust Point to Scott Point.—Scott Point is 12⅛ (14) miles E. by S. of Locust Point, the shore between receding and forming a bight 4⅛ (5) miles deep. The flat extends 5¼ (6) miles to the eastward from Locust Point, then turns sharply to the SSW. and approaches the shore to a mile, then extends to the eastward, filling the bight between Locust Point and Moore Point, the west point of Catawba Island. Between Moore and Scott points, Catawba Island is bluff and steep-to. Just north of Scott Point is Mouse Island, connected to the point by a flat.

Port Clinton is at the head of the bight between Locust and Scott points.

Depths.—The channel has been dredged to a depth of 10 feet for a width of 100 feet between the piers; the harbor in front of the wharves has been dredged for a width of 200 feet and to a depth of about 10 feet; the bar has been dredged outside to a depth of 10 feet.

Mouse Island Reef, least water 12 feet, lies one mile north of Mouse Island.

Buoy.—A black can buoy is moored in 16 feet of water on the NW. end of this reef. The shoalest water on the reef is 150 yards SW. by W. from the buoy. Vessels must pass north of this buoy.

Starve Island Reef, 400 feet in diameter, least water 11 feet, lies one mile ENE. of Mouse Island Reef. The track of vessels lies between these two shoals. This shoal lies exactly on the range of Green Island lighthouse and the SW. point of South Bass Island. When Green Island lighthouse can be seen open south of South Bass Island vessels are clear of the shoal to the southward. Two-thirds of the way from this reef to Starve Island is a rocky patch, with 11 feet of water over it.

Buoy.—A red nun buoy is moored in 14 feet of water on the SW. end of Starve Island Reef. Vessels must pass south of this buoy.

Scott Point Shoal, least water 12 feet, is a rocky shoal on the south of the channel. It is 400 yards wide and from its NW. end stretches toward, and halfway to, Mouse Island, leaving a channel ½ mile wide between the shoal and the island. SE. of this shoal is an 18-foot patch ½ mile long east and west.

Buoy.—A black can buoy is moored in 16 feet of water on the NE. end of the shoal and lies very close to the track of vessels through the channel. This buoy should be left to the southward in passing.

Scott Point (eastward) to Cedar Point.—This portion of the coast is much indented. Flats extend off the east side of Catawba Island ⅝ mile. Off West Harbor, which is filled with shoals, flats and rocky shoals

extend in a spit nearly 1½ miles, with 4 feet near its end; off East Harbor, also filled with shoals, flats extend ⅝ mile; they then near the shore, and close to the United States Life Saving Station west of Marblehead lighthouse the shore is steep-to. Sand Point is 1¾ (2) miles south of Marblehead lighthouse; between these two points flats extend across to Cedar Point, filling the entrance to Sandusky Bay.

North of this portion of the coast are numerous islands which reach almost to the north shore of Lake Erie and amongst which are numerous shoals. These islands and shoals are described in Chapter III.

Marblehead Light.—On the northeastern end of the Marblehead Peninsula is a fixed white light, shown 67½ feet above the lake level and visible 14 (16) miles. The lighthouse is a white conical tower; the dwelling, light buff, is westward of the tower.

Sandusky Bay forms a natural harbor, separated from Lake Erie on the north and NW. by Marblehead Peninsula, and on the east by Cedar Point, which is also a peninsula. This bay, which is from 8 to 12 feet deep, is protected from the effect of storms by a bar extending across the entrance, except for a short distance where the channel passes Cedar Point. The depth on the bar is from 4 to 6 feet, excepting where dredged.

Currents.—The currents from the eastward set toward Marblehead Point, being deflected at times so that they enter Sandusky Bay between Marblehead and Cedar points, in the channel and across the flats, then, flowing eastward in the bay, they follow the east shore line and set southward until they reach the extreme south shore, when they are deflected to the westward.

Johnson Island, a large island, lies just within Sand Point in the northern part of the bay.

Sandusky River empties into the NW. part of the bay, 12½ (14½) miles by channel from Lake Erie. Fremont, at the head of navigation, is 15⅞ (18) miles from the bay. Eight feet can be carried to Fremont.

Sandusky, at the southeastern end of the bay, has numerous wharves and railroad docks.

Channel.—The channel consists of an outer channel across the bar at the entrance to the bay; a natural channel between Sand Point and Cedar Point shoals, and an inner dredged channel in one straight reach leading up to the Baltimore and Ohio Railroad docks in the city of Sandusky. The channel is $2\frac{8}{10}$ (3¼) miles long, the bottom and banks are sandy until halfway through the straight cut, where both are soft. The dredged channel is 200 feet in width and dredged to 15 feet depth at mean lake level. The spar buoys on the banks of the dredged part of the channel stand within a few feet of the edge. There is a dredged channel 89 feet wide, with 17 feet depth at mean lake level, extending in front of the docks to the west end of the city.

Directions.—The Outside Buoy, No. 2, may be approached from the eastward on any course between NW. and SE. by E. It is just to the northward of the Cedar Point range line. From it steer SW. ¼ W., on the range past North Shoal Outer Buoy, No. 8., to South Shoal Buoy, No. 1, then haul to the westward and steer a course to carry between Cedar Point Buoy, No. 3, and Turning Buoy, No. 14. When abreast of No. 14 haul to port for the entrance to the straight channel between buoys Nos. 5 and 16, and steer S. by W. ½ W. (S. 16° 52′ W.) for the City Hall Tower. There are buoys on each side of this channel.

BUOYS.

Outside Buoy, No. 2, is a red can buoy.

Outer Bar Buoy, No. 4, is a red spar buoy in 13 feet of water.

Inner Bar Buoy, No. 6, is a red spar buoy.

North Shoal (outer) Buoy, No. 8, is a red spar buoy in 14 feet of water.

South Shoal Buoy, No 1, is a black spar buoy.

North Shoal (inner) Buoy, No, 10, is a red spar buoy.

Sand Point Buoy, No. 12, is a red spar buoy.

Cedar Point Buoy, No. 3, is a black spar buoy.

Turning Buoy, No. 14, is a red spar buoy in 14 feet of water and marks the turning point into the new straight channel.

Entrance to Straight Channel (outer) Buoy, No. 5, is a black spar buoy in 14 feet of water on the east side of the entrance to the dredged channel.

Entrance to Straight Channel (outer) Buoy, No. 16, is a red nun buoy in 15 feet of water on the west side of the entrance to the dredged channel, and of the SE. bank of the deep hole.

Channel Buoys.—The straight channel is marked by four black spar and three red spar buoys, and the

End of Channel (inner) Buoy, No. 24, is a red spar buoy in 13 feet of water, marking the west side of the inner entrance to the straight channel.

Dock Channel Buoys.—Six buoys mark the channel extending along the city docks.

LIGHTS.

Cedar Point Range (front).—On the crib at the outer edge of Cedar Point, 600 feet NE. of the main (rear) light, is a fixed red light 28½ feet above lake level, and visible 7⅛ (8½) miles. The light is shown from a white building on a crib and is moved from time to time to correspond with the shifting of the line of best water at the outer bar; this light should not be approached nearer than ⅓ mile on the range, nor passed, entering, nearer than 600 feet.

Rear (main).—On Cedar Point is a fixed white light 48½ feet above the lake level and visible 12⅓ (14¼) miles. The light is shown from a low white tower on a dwelling.

SANDUSKY BAR RANGES.

Front (for both).—On the outer NW. bank, at the elbow of the dredged channel is a fixed white light 21½ feet above the lake level. The light is shown from a white, square building 11 feet above its crib.

Rear (west).—At 1,000 feet to the westward of the front beacon is a fixed white light 45 feet above the lake level. This light and the rear (east) light are shown from brown iron shafts with octagonal lanterns on cribs.

Rear (north).—At 1,000 feet northward of the front beacon is a fixed white light 45½ feet above the lake level.

These form the following ranges and mark the channel from Cedar Point to the city:

Front and west beacons in line show the range from Cedar Point to the front beacon.

Front and north beacons in line show the range from the front beacon to the bend in the dredged channel, ½ mile beyond.

West beacon and illuminated clock of the city hall in line leads from the bend in the dredged channel to the city docks.

Sandusky to the Welland Canal and Buffalo.—When one mile clear of the bar a NE. by E. ⅝ E. (N. 63° 16′ E.) course for 167⅞ (193) miles, passes 4 (4½) miles south of Long Point lighthouse, which should be sighted, and will carry a vessel 7 (8) miles S. by W. (S. 11° 15′ W.) of Port Colborne Range lights, at the entrance to the Welland Canal. From this point to off Buffalo Breakwater the course is ENE. (N. 67° 30′ E.) and the distance 17⅓ (20) miles, passing northward of Waverly shoal and buoy.

Sandusky to Huron.—From Cedar Point to Huron lighthouse the coast trends SE. for 8¼ (9½) miles. SE. of Cedar Point the shoal bank approaches the shore, and the 3-fathom line is less than ½ mile off shore.

Shoal.—A rocky shoal of 18 feet lies ¾ mile off shore and 1⅜ (1⅞) mile NW. of Huron lighthouse; it has 4 to 4½ fathoms around it.

Huron is at the mouth of the Huron River. Piers have been built and the bar dredged; width between the piers 125 feet. The piers extend NE. ½ N.

Depth.—June, 1895, a survey showed a general depth of 18 feet between the piers except at the outer end, where the depth was 17 feet. A small bar was forming outside the end of the east pier with a least depth of 14 7/10 feet on the side and 15 8/10 feet in mid-channel. Shifting sands cause depths to vary from time to time.

Light.—Twenty feet from the end of the west pier a fixed white light is shown from a brown skeleton tower 40¼ feet above the lake level. It is visible 11¾ (13½) miles.

Directions.—Keep in 5 fathoms until the light is made out, when bring it to bear ahead SW. ½ S. (S. 39° 22′ W.) and stand in between the piers.

Huron to Vermillion.—Vermillion lighthouse is 8½ (9¾) miles E. by N. of Huron lighthouse, the shore between receding to the southward and forming a small bight. A short distance to the eastward of the head of the bight the flat leaves the shore again and extends in a spit for nearly a mile; it then follows the shore at the distance of nearly ¼ mile.

Huron to the Welland Canal and Buffalo.—When one mile NE. of the bar a NE. ½ E. (N. 61° 52′ E.) course for 165 (190) miles, passes 5⅝ (6½) miles south of Long Point lighthouse, which should be sighted, and will carry a vessel 7 (8) miles S. by W. (S. 11° 15′ W.) of Port Colborne Range lights at the entrance to the Welland Canal. From this point to off Buffalo Breakwater the course is ENE. (N. 67° 30′ E.) and the distance 17⅓ (20) miles, passing northward of Waverly shoal and buoy.

Vermillion is at the mouth of the Vermillion River. The bar has been improved from time to time by the building of piers and dredging. Width between the piers 130 feet. Direction of the piers N. ¼ W. (N. 2° 48′ W.).

Bar.—The depth between the piers at Vermillion varies less than at most other places on the lake. The depth in the channel at mean-water level is from 12 to 14 feet. November, 1895, 10⅝ feet, mean lake level, were found on a bar which has formed at the mouth of the piers.

Light.—On the west pier, 84 feet from the outer end, a fixed red light is shown 34 feet above the lake level and visible 8½ (9¾) miles from a brown, octagonal structure.

Directions.—Keep in over 4 fathoms until the light is made out; bring it to bear ahead S. ¼ E. (S. 2° 48′ E.) and stand in between the piers.

Vermillion to the Welland Canal and Buffalo.—When one mile north of the bar a NE. by E. ⅜ E. (N. 60° 28′ E.) course for 158 (182) miles, passes 6 (7) miles south of Long Point. lighthouse, which should be sighted, and will carry a vessel 7 (8) miles S. by W. (S. 11° 15′ W.) of Port Colburne Range lights at the entrance to the Welland Canal. From this point to off Buffalo Breakwater the course is ENE. (N. 67° 30′ E.) and the distance 17⅓ (20) miles, passing northwest of Waverly shoal and buoy.

Vermillion to Black River.—Black River Lighthouse (rear) is 8⅜ (10) miles ENE. ½ E. of Vermillion lighthouse, the coast between trending east and then ENE. The flats to the eastward of Vermillion extend ½ mile off shore for a short distance, they then approach the shore to the distance of ¼ mile and the 3-fathom line is not more than this distance from the shore to Black River entrance.

Lorain.—Black River Harbor is in the township and city of Lorain, where the Black River empties into the lake. In its natural condition

there were only 3 feet of water over the bar at the mouth of the river, but this has been improved by the construction of piers and dredging. Width between the piers is 200 feet; direction of the piers NW.

Bar.—A 14-foot bar formed on line of the east pier, 500 feet into the lake, extending halfway across the entrance. Seventeen-foot depth in the west half of the entrance. Shifting sands cause these depths to vary from time to time.

RANGE LIGHTS.

Front.—On the west pier, 29½ feet from the outer end, 47 feet above the lake level and visible 12⅛ (14) miles is a fixed white light, shown from a square, pyramidal tower, brown below and white above.

Rear.—Near the shore end of the west pier, 1,070 feet from the front light are three fixed lights—red, white, red—shown vertically. The lights are respectively 65½, 61½, 57½ feet above the lake level and are shown from a square, pyramidal skeleton tower, the foundation of which is red, the skeleton white, and the roof black.

These lights form a range for entering the harbor.

Directions.—Keep in 5 fathoms water until the range comes on, when stand in on the range and between the piers into the harbor.

ROUTES.

Lorain (Black River Harbor) to the Welland Canal and Buffalo.—When one mile north of the bar a NE. by E. ½ E. (N. 59° 03′ E.) course for 149⅓ (172) miles passes 6¾ (7¾) miles south of Long Point light (which should be sighted), and will carry a vessel 7⅛ (8) miles S. by W. (S. 11° 15′ W.) of Port Colborne lights at the entrance to the Welland Canal. From this point to off the Buffalo Breakwater the distance is 17⅓ (20) miles, and the course ENE. (N. 67° 30′ E.), passing northward of Waverly shoal and buoy.

Lorain (Black River Harbor) to Cleveland.—From Black River to Avon Point the coast trends ENE. for 8 (9½) miles and the 3-fathom line is nowhere at a greater distance than ½ mile from the shore. Avon Point, broad and rounding, has shoals all around to the distance of ½ mile. At Avon Point the coast bends around to the SE. and then takes a general easterly direction to Cleveland Pier lights, which are 13¾ (15½) miles E. ½ S. from Avon Point.

Caution.—A crib (intake of Cleveland waterworks) lies in 6 fathoms of water one (1½) mile nearly west of the light on the end of the west breakwater and one (1½) mile off shore. It is a serious menace to navigation, as the white light on it (an ordinary ship's lantern) is irregularly lighted and often not lighted at all.

Cleveland is at the mouth of the Cuyahoga River, which was originally obstructed by a long sand bar, the channel was crooked and the depth of

water over the bar was but 3 feet. The river has been straightened, piers have been built, and a breakwater constructed, forming an outer harbor and making it a safe harbor of refuge.

Breakwater.—The shore arm of the west breakwater starts from a point 700 feet west of the old bed of the Cuyahoga River and 5,950 feet west of the west pier of the present channel; this arm runs into the lake nearly north a distance of 3,130 feet, where it is joined to the breakwater proper. The west breakwater is nearly parallel to the shore and is 4,030 feet long. At a point 200 feet from its eastern end a spur 100 feet long runs out at right angles, breaking the force of the heavy seas and currents which run along the breakwater during northwesterly gales. These currents add greatly to the difficulty of taking vessels into the harbor.

The east breakwater commences on the prolongation of the west arm, leaving an opening of 500 feet. It is intended to build 3,500 feet on this line, and then to incline toward the shore for a farther distance of 2,000 feet.

A spur similar to the one on the west breakwater has been constructed. In 1895, 2,500 feet of this breakwater had been completed.

New Entrance.—There is an opening 201 feet wide through the shore arm of the west breakwater. The outer end of this opening is 1,308 feet from the outside angle of the breakwater. This opening has been dredged to a depth of 16 feet.

Depths.—In June, 1895, there were from 17 to over 20 feet in mid-channel from the breakwater to the Railroad bridge. The anchorage in the harbor of refuge is accessible to vessels drawing 19 feet, and there is ample room, although there are several 18-foot spots. The deposit from the river and the lake causes the depths to vary from time to time.

Branch Hydrographic Office.—The United States Hydrographic Office has a branch office in the Arcade building at Cleveland.

The office is supplied with all the latest information pertaining to the lakes, also nautical books and instruments, all of which are open for consultation or reference to the lake mariners or other interested parties.

Time Ball.—The time ball is dropped by the branch office at noon every day (Sundays excepted) from the flagstaff on top of the Arcade building. The ball is hoisted 5 minutes before noon, central standard time, and is dropped exactly at noon. Should the ball be dropped before the exact instant of noon, it will be hoisted immediately, and kept up until 5 minutes after noon (12h. 05m.) and then lowered slowly. Should the ball fail to drop exactly at noon it will be kept mastheaded until 5 minutes after noon (12h. 05m.) and then lowered slowly.

Life Saving Station.—A Life Saving station is at the west side of the entrance to Cleveland Harbor.

LIGHTS.

West Breakwater (east end).—On a crib just inside of the end of the breakwater, from a brown, octagonal pyramidal tower, 35½ feet above the lake level, is shown a light, flashing alternately red and white, the intervals between the flashes being 10 seconds. The light is visible 11¼ (13) miles.

Fog Signal.—From a brown house on the same crib a 10-inch steam whistle is sounded as follows: Blast 3 seconds, silent interval 57 seconds.

East Breakwater (west end).—Near the west end of the East Breakwater, from a mast, is shown a fixed red light 25 feet above the lake level.

Caution.—The unfinished work on the east end of the East Breakwater is not marked by a light or daymark.

West Pier.—On the West pier, 53 feet from the outer end, from a square, brown, pyramidal tower, is shown, 47 feet above the lake level, a fixed white light, visible 11¼ (13) miles.

East Pier.—On the East pier, 37 feet from the outer end, from a similar tower is shown, 37 feet above the lake level, a fixed red light, visible 7⅓ (8½) miles.

Directions.—When off the breakwater, bring the east pier light (fixed red) to bear SE. by S. (S. 33° 45′ E.) and run in through the opening and between the piers.

Caution.—With westerly winds a strong set makes along the breakwater, and caution should be used in making the entrance.

ROUTES.

Cleveland to the Welland Canal and Buffalo.—From 1¾ (2) miles off the breakwater entrance a NE. ⅝ E. (N. 52° 01′ E.) course for 95 (109½) miles will take a vessel 1¾ (2) miles south of Long Point lighthouse; from here

To Port Colborne, at the entrance to the Welland Canal, the course is NE. by E. ¼ E. (N. 59° 03′ E.) and the distance 40⅓ (46½) miles.

To Buffalo, the course is ENE. (N. 67° 30′ E.), and the distance is 54 (62¼) miles, passing northward of Waverly shoal and buoy.

The routes from the Detroit River to Cleveland are given on page 18.

Cleveland to Fairport.—The coast trends NE. for 24½ (28¼) miles and is generally safe to approach to the distance of ½ mile.

At 1¾ (2) miles west of Fairport the flats extend somewhat farther from the coast, and along here vessels should not approach within one mile.

Fairport is near the mouth of the Grand River. This river was originally closed by a hard sand bar, but it has been improved from time to

time by the building of piers and dredging, so that there is now usually a 19-foot channel. Width between the piers is 180 feet. Direction of the piers, N. ⅛ W.

Bar.—A dangerous bar works across the mouth of the piers from the westward, with crest about 150 feet from end of the west pier; sometimes less than 13 feet on crest. An outside bar also forms. A channel was dredged through the bar in May, 1895, to 18 feet depth. Between the piers the depth is usually 17 feet.

Life Saving Station.—The Life Saving station is at the inner end of the west pier.

Note.—The Life Saving station keeper reports as follows, November, 1895: The only danger to navigation at or near Fairport is the natural formation of sand bars which occur each year, and which, on account of the extremely low stage of the water, are dangerous in entering the harbor. The outside bar, 1,200 feet from the end of piers, has only 12 feet over it in places, but by keeping well to the eastward in entering, masters will avoid shoal spots. The inside bar is much worse, there being only 8 or 10 feet of water. The bar is about 90 feet from the end of the piers. There is a dredge at work cutting a channel from in range with the east pier, extending west about 75 feet, with a 17½-foot depth. In entering the harbor, unless perfectly familiar with the channel, it would be advisable to take a tug.

LIGHTS.

Fairport.—On the bluff on the east side of the mouth of Grand River, from a conical gray tower, is shown, 102¼ feet above the lake level, a fixed white light, visible 16 (18½) miles.

Range (front).—Twenty-one feet from the outer end of the east pier, from a square, pyramidal tower, brown below and white above, is shown, 37 feet above the lake level, a fixed white light, visible 11 (12¾) miles.

Range (rear).—Near the shore end of the east pier, 1,000 feet in the rear of the front light, from a brown, triangular, pyramidal skeleton tower are shown 3 lights, 4 feet apart and placed vertically. The lights are red, white, red. The middle light (white) is 52 feet above the lake level. The lights form a range for entering the harbor.

Directions.—Keep in over 5 fathoms until the range comes on, when stand in on the range and between the piers into the harbor.

ROUTES.

Fairport to the Welland Canal.—From 1¾ (2) miles north of Grand River lights, a NE. ¾ E. (N. 53° 26′ E.) course for 109½ (126) miles passes 6 (7) miles south of Long Point light and will take a vessel off Port Colborne lights at the entrance to the Welland Canal.

Fairport to Buffalo.—From $1\frac{3}{4}$ (2) miles north of Grand River lights a NE. by E. $\frac{1}{8}$ E. (N. 57° 39′ E.) course for $122\frac{1}{2}$ (141) miles will take a vessel off the breakwater at Buffalo, passing north of Waverly shoal and buoy.

Fairport to Ashtabula.—The coast between these ports trends ENE. for $23\frac{1}{4}$ ($26\frac{3}{4}$) miles. The 3-fathom line is less than $\frac{1}{2}$ mile off shore, except just west of Ashtabula, where there are 17 feet at this distance.

Ashtabula is at the mouth of the Ashtabula River. Originally the bar at the mouth of the river had but 2 feet of water over it, and the rock bottom was but 9 feet below the surface of the lake. The river has been improved from time to time by the building of piers and dredging; width between piers, 213 feet; direction of piers, N. $\frac{1}{8}$ E.

Depths.—Depth outside of the piers, 17 to 21 feet for the full width of 213 feet. Between the piers the channel depth is 17 feet to the bridge; at the sides of the channel the depth decreases in places to 12 feet. Shifting sands cause these depths to vary from time to time.

Life Saving Station is on the beach, west side of the entrance to the river.

RANGE LIGHTS.

Ashtabula (front).—On the west pier, $27\frac{1}{2}$ feet from the outer end, from a square pyramidal tower, brown below and white above, is shown a fixed white light, $35\frac{1}{2}$ feet above the lake level and visible $11\frac{1}{4}$ (13) miles.

Pierhead (rear).—Near the shore end of the West pier, 1,500 feet in the rear of the front light, from a brown triangular, pyramidal skeleton tower, are shown 3 lights—red, white, red—placed vertically and 4 feet apart. The middle light (white) is 52 feet above the lake level.

The lights form a range for entering the harbor.

Fog Signal.—At Ashtabula light station the fog signal is a 6-inch steam whistle, which sounds as follows: Blast 3 seconds, alternate silent intervals of 12 and 42 seconds.

Directions.—Keep in over 5 fathoms until the range comes on, when stand in on the range, between the piers, into the harbor.

ROUTES.

Ashtabula to the Welland Canal.—From $1\frac{3}{4}$ (2) miles north of the lighthouse a NE. $\frac{1}{2}$ E. (N. 50° 37′ E.) course for $86\frac{7}{8}$ (100) miles will take a vessel off Port Colborne lights at the entrance to the Welland Canal.

Ashtabula to Buffalo.—From $1\frac{3}{4}$ (2) miles north of Ashtabula lighthouse a NE. by E. (N. 56° 15′ E.) course for $99\frac{1}{2}$ ($114\frac{1}{2}$) miles will take a vessel off the Buffalo breakwater. This course passes close to Waverly Shoal.

Ashtabula to Conneaut.—Between these ports the course continues ENE'ly for 11¾ (13½) miles, and the 3-fathom line is nowhere at a greater distance than ½ mile off shore.

Conneaut, at the mouth of the Conneaut River, is very near the boundary line between Ohio and Pennsylvania. The river had an original depth of 2 feet over the bar. The bar is being improved and will have a width of 200 feet between the piers. Direction of the west pier is N. by W. ¼ W.

Piers—Depth.—December, 1893, 400 feet of the new west pier had been constructed and a small beacon placed near its outer end, 900 feet from the shore. The railroad company has repaired the old piers to some extent and dredged the entrance to 17 feet. Shifting sands cause these depths to vary from time to time.

LIGHTS.

Conneaut.—On the bluff, just west of the harbor, from a square, pyramidal tower, brown below and white above, is shown a fixed white light, 69 feet above the lake level and visible 11¼ (13) miles.

Pierhead.—On the west pier, 25 feet from the outer end, from 2 white uprights, is shown, 20 feet above the lake level, a fixed white light.

Directions.—When in 5 fathoms bring the pierhead light to bear S. by E. ¼ E. (S. 14° 03′ E.) and stand in on this bearing and between the piers.

ROUTES.

Conneaut to the Welland Canal.—From 1¾ (2) miles north of Conneaut light a NE. ⅜ E. (N. 49° 13′ E.) course for 76½ (88) miles will take a vessel off Port Colborne lights at the entrance to the Welland Canal.

Conneaut to Buffalo.—From 1¾ (2) miles north of Conneaut light a NE. ⅞ E. (N. 54° 50′ E.) course for 88½ (102) miles will take a vessel off the Buffalo Breakwater. This course passes close to Waverly Shoal.

Conneaut to Presque Isle Peninsula.—From Conneaut to Presque Isle Peninsula, the coast trends ENE. for 19⅓ (22¼) miles. The shore can be approached anywhere in this stretch to ¾ mile. The depth at this distance is generally from 5 to 6 fathoms, except in the first 4⅓ (5) miles, where it is 4 fathoms. NW. nearly a mile from the mouth of Crooked Creek and ¾ mile off shore is a 3½-fathom spot.

Presque Isle Peninsula trends NNE., gradually bending to the eastward, and widening protects Erie Harbor from the north and west. The peninsula is much indented on its south shore, and in it are several small lakes. The west shore of the peninsula should not be approached within ⅛ mile. Misery Bay, at its SE. end, is filled with flats.

Presque Isle Light.—On the northern shore of Presque Isle Peninsula, 400 feet from the lake, from a square, red tower, attached to a dwelling, is shown, 56 feet above the lake level, a light, flashing alternately red and white, the interval between the flashes being 10 seconds. The light is visible 13 (15) miles. When the trees are in leaf this light is partially obscured in the bight at the entrance to Erie Harbor.

Erie Harbor (Presque Isle Bay), protected by Presque Isle Peninsula, has been artificially improved; outside of the 3-fathom line it is over 1¾ (2) miles long by a mile broad, the width being somewhat contracted by a spit extending into the harbor from the middle of the south shore of Presque Isle Peninsula. It is the finest natural harbor on the lake and has accommodation for a large number of vessels.

Erie, on the south shore of the lake, is on a bluff and has a large number of docks and wharves.

Improvements.—The present works consist of (1) the south breakwater, extending northerly from the main shore; (2) a pier on the south side of the entrance channel, extending easterly from the breakwater; (3) a pier on the north side of the entrance channel, parallel to the south pier and 350 feet distant, and (4) a catch-sand jetty built about 3,000 feet north of the north pier—this jetty did not serve its purpose and has received no repairs since its construction.

Depth in the Channel.—July, 1895, the depth of water was 18 to 20 feet at mean lake level, or not less than 16½ feet at low water for a channel width of not less than 275 feet.

Currents.—SW. gales cause a strong incurrent through the channel and NE. gales a strong outcurrent.

Buoys.—A red can buoy is moored in 18½ feet of water on the prolongation of the inner face of the north pier and marks the northern side of the entrance to the channel. A black spar buoy is moored in 16 feet of water on the prolongation of the south pier and 250 yards outside of the end of the north pier. This buoy is 350 yards within the outer edge of the spit extending along the south side of the entrance channel. The outer edge of this spit is south of the north outer buoy. There are 6 other buoys (red to starboard and black to port) marking the channel in entering. The inner buoy on the north bank is a gas buoy, red, showing a fixed white light.

Life Saving Station.—There is a Life Saving station on the middle of the north pier, adjoining the light station.

LIGHTS.

Erie.—Eastward of Erie Harbor, on a high bluff, from a conical tower, is shown, 128 feet above the lake level, a fixed white light, visible 17⅓ (20) miles.

The light is obscured by trees on Presque Isle Peninsula through the greater part of the arc between the bearing SE. by E. ½ E. (S. 61° 52′ E.) and east.

Presque Isle (north) Pierhead.—On the north pier, 30 feet from the outer end, from a square, white, pyramidal tower, with brown trimmings, is shown, 40 feet above the lake level, a fixed red light, visible 11¼ (13) miles. With Erie Range No. 1 in line bearing SW. by W. ½ W. (S. 61° 52′ W.) it forms a range for approaching the piers.

Fog Signal.—At this station a bell is struck by machinery every 20 seconds.

ERIE RANGE.

No. 1 (front).—On the north pier, 8 feet from the west end, from a white, octagonal lantern on a skeleton base, is shown, 18 feet above the lake level, a fixed white light, visible 9⅓ (10⅝) miles.

Note.—After passing this light bring it in range astern with No. 2, rear, bearing NE. by E. (N. 56° 15′ E.). This range carries through the best water in the dredged channel into deep water of the harbor.

No. 2 (rear).—NE. by E. (N. 56° 15′ E.) 908 feet from No. 1 light is a fixed white light, 46 feet above the lake level. The light is suspended from a white mast with a round black disc, 5½ feet in diameter, above the lantern.

Erie Harbor—Shoal.—North of the elevator 300 feet there is a 15-foot shoal.

Directions.—Coming from the westward, Erie Main light (fixed white) will probably be made out first, and then Presque Isle light (flashing red and white); this latter light can be approached to one mile and Presque Isle peninsula rounded at that distance. When Erie Main light (fixed white) bears S. ½ E. (S. 5° 37′ E.) steer for it on this bearing until the range, Presque Isle pierhead (fixed red) and Erie range No. 1 (fixed white), come in line bearing SW. by W. ½ W. (S. 61° 52′ W.); run in on this range, passing south of the red can buoy on the end of the shoal extending from the north pier, and remembering that the outer black spar buoy No. 1 is not on the outer end of the spit on the prolongation of the south pier, but halfway between the outer end of the spit and the outer end of the south pier.

After passing Erie Range light No. 1, bring this light and Erie Range No. 2 (fixed white) in range astern, bearing NE. by E. (N. 56° 15′ E.); keep this range on astern and run in between the buoys into deep water of the harbor.

Approaching from the eastward, Erie Main light (fixed white) will be made out first. It should be approached on a SW. (nothing to the westward) bearing until the range SW. by W. ½ W. (S. 61° 52′ W.) comes on, when proceed in as directed above.

ROUTES.

Erie to the Welland Canal.—From 1¼ (2) miles off the range lights, a NE. ⅜ N. (N. 40° 46′ E.) course for 53⅞ (62) miles will take a vessel off Port Colborne lights, at the entrance to the Welland Canal.

Erie to Buffalo.—From 1¾ (2) miles off the range lights a NE. ½ N. (N. 50° 37′ E.) course for 65½ (75) miles will take a vessel off the Buffalo breakwater. This course passes south of and quite close to Waverly Shoal.

For the route from the Detroit River to Erie, see page 19.

Erie to Dunkirk.—From Erie to Dunkirk the coast trends NE. by E. for 38 (43¾) miles. The shore can be approached anywhere to ¾ mile, except one mile NE. of Van Buren Point, where a spit extends from the shore to the westward for a little over a mile. There are only 5 feet of water on this spit, ¾ mile from the shore. Several small creeks empty into the lake in this stretch and 24⅓ (28) miles NE. of Erie, on Chautauqua Creek, is Barcelona. The boundary line between the States of Pennsylvania and New York is 8⅔ (10) miles SE. of this town, just east of Twenty-Mile Creek.

Dunkirk is on an artificial harbor, protected by a pier and a partially completed breakwater. July, 1895, the channel entrance had a depth of 13 feet for a width of 100 feet, and 13 feet at the docks. A sand bar makes out from the beacon light in a NE. direction, on which there is only 12 feet.

Improvements.—July 1, 1895, the protections for the harbor consisted of a pier running from the west shore of the indentation and a detached breakwater nearly 2,860 feet long; one part of which, 2,300 feet long, is to be nearly parallel with the shore and the other part, 560 feet, nearly parallel to the axis of the channel entrance. The pier has its full length. Of the breakwater, 1,991 out of 2,300 feet have been finished. The 560-foot section has not been built.

Buoys.—A beacon buoy, black spar, is moored in 17 feet of water at the north side of the entrance to the channel. It may be rounded on the west side at 50 yards. A red spar buoy (Outer buoy) is moored in the channel close to the south side of the entrance, and marks the outer end of a ledge of rocks just covered, extending along the south bank of the channel nearly to the Inner buoy. A straight course may be steered between these (Outer and Inner) buoys. Inner buoy, red spar, is moored in 10½ feet of water, on the south side of the excavated channel.

LIGHTS.

Dunkirk.—West of the harbor entrance, on a bluff point, from a square, reddish gray tower, is shown, 82 feet above the lake level, a fixed white light, varied by a white flash every 90 seconds, and visible 14¾ (17) miles.

Dunkirk Pierhead.—On the outer end of the pier, SW. side of the

entrance to the harbor, from an octagonal brown tower on a square superstructure, is shown, 38½ feet above the lake level, a fixed red light, visible 11¼ (13) miles. This light is shown whenever the weather is such that it can be reached.

Directions.—Making this harbor from the eastward, steer for the entrance between Dunkirk Pierhead lighthouse and the beacon buoy, and nothing inshore of a SW. by S. (S. 33° 45′ W.) course. From the westward keep in over 4 fathoms until the Pierhead lighthouse bears SW. by S. (S. 33° 45′ W.), when the channel entrance can be run for. The channel in is straight and marked on its south side by 2 red buoys.

During northerly gales a heavy swell sets into the harbor past the east end of the breakwater, rendering berths at the docks insecure.

ROUTES.

Dunkirk to the Welland Canal.—From ½ mile NW. by N. (N. 33° 45′ W.) of Dunkirk Pierhead lighthouse, a N. ⅞ E. (N. 9° 50′ E.) course for 22½ (26) miles will take a vessel off Port Colborne lights, at the entrance to the Welland Canal.

Dunkirk to Buffalo.—From ½ mile NW. by N. (N. 33° 45′ W.) of Dunkirk Pierhead light, a NE. ⅜ N. (N. 40° 46′ E.) course for 30 (34½) miles will take a vessel off Buffalo breakwater, passing well southward of Waverly Shoal.

Dunkirk to Buffalo (coast).—From Dunkirk to Silver Creek, NE. by E. 7 (8) miles, the shore line is very irregular and projects into the lake in several small points, all of which have spits extending from them; here it is best to keep at least 1 3/10 (1½) miles from the shore. At Silver Creek the coast line changes direction to the NNW. to Sturgeon Point, which is 10½ (12) miles distant. This part of the coast is also uneven, with several projecting spits for a distance of a mile. Off Big Sister Creek, 2⅜ (3) miles SW. ½ S. of Sturgeon Point, and one (1¼) mile off shore is a rocky shoal, with 6 feet least water. The shoal extends ½ mile NE. and SW. and is ¼ mile broad. At Sturgeon Point the coast line again changes direction to NE. by E. and continues for 10¼ (11¾) miles to Hamburg, where it again changes direction to a little west of north and so continues for 6 (7) miles, to the entrance of Buffalo Harbor. This stretch of coast is rather more even, but, on account of 2 rocky and extensive offlying shoals, lying north of Hamburg, it should not be approached nearer than one (1¼) mile.

Seneca Shoal lies 3¼ (3¾) miles off Hamburg, where the coast changes its direction to the northward. The shoal is nearly ½ mile north and south, by ⅜ mile wide. It is rocky, with a least depth of 15 feet.

Buoy.—A black spar buoy is moored in 17 feet of water on the NW. side of the shoal. The 15-foot spot is 100 yards NE. from the buoy.

Waverly Shoal.—The NE. end of this shoal lies 2 ($2\frac{3}{16}$) miles SW. by W. $\frac{5}{8}$ W. (S. 63° 16′ W.) from the light on Buffalo Breakwater. The shoal is 100 feet wide and extends 700 yards SW. and NE. Least water, 12 feet, is 400 feet SW. of the buoy. There is a small 16-foot detached spot a little eastward of the north end of the shoal.

Buoy.—A red and black, horizontal-striped, can buoy is moored in 13 feet of water near the NE. end of the shoal.

Buffalo, on Buffalo Creek, is at the NE. end of Lake Erie, where it contracts to form the Niagara River. It extends along the river for some distance, and on the opposite shore is Fort Erie.

Improvements.—The object of the improvements is to protect the entrance to Buffalo Harbor, the south shore of Buffalo Creek, and to form an outer harbor of refuge.

The improvements are: North and south piers at the entrance to the creek (completed); masonry sea wall (completed); sand-catch or pile pier, and breakwater and shore arm.

The sand catch extends into the lake at a point 8,000 feet southward of the south pier. The breakwater, commencing about on a line of the south pier extended, lies parallel to and $\frac{1}{2}$ mile from the shore. This breakwater has its full length of 7,600 feet. The shore arm of the breakwater is intended to cover the opening between the south end of the main breakwater and the shore, leaving a passageway for vessels. Some 1,150 feet at the outer end of this shore arm had been completed, but in October, 1893, it was so badly wrecked by a storm that no attempt has been made to repair it.

Depths.—Twenty-three feet can be carried into the outer harbor. The Buffalo River and Blackwell Canal is maintained by the city on the basis of an 18-foot depth at low water, as established by the city, which would give about 19 feet at mean lake level. Actual depth allows about 16 feet draft.

BUOYS AT THE ENTRANCE TO THE NIAGARA RIVER.

Horseshoe Reef.—A black spar buoy is moored in 17 feet of water and marks the south end of Horseshoe Reef, lying between Middle Reef and Buffalo.

It also marks the east side of the entrance to the Emerald Channel.

Emerald Channel.—A red can buoy is moored in 14 feet of water and marks the north end of Middle Reef and the south side of the northern entrance to Emerald Channel.

Middle Reef.—A black spar buoy is moored in 13 feet of water and marks the west point of Middle Reef. Shoal water makes out from the Canadian shore opposite for more than one-third the way across, leaving a channel about $\frac{1}{3}$ mile wide.

Bird Island Reef.—A black spar buoy is moored in 14 feet of water and marks the western point of a reef making out from Black Rock Harbor pier, near its upper end. There are from 4 to 9 feet of water between the buoy and the pier; 17 feet in the channel between this and the buoy opposite.

Limekiln Reef.—A red nun buoy is moored in 14 feet of water, 700 yards from the Canadian shore and nearly opposite Bird Island Reef buoy. It marks the eastern point of a reef with 8 to 10 feet water on it. The range from this buoy to the west shore at the head of Narrows marks the west side of the channel.

Southeast Shoal.—A black spar buoy is moored in 13 feet of water, about 100 yards SE. of the line of the Niagara River Range lights, and shows the limit of the channel above the line.

Fort Erie Point.—A red nun buoy is moored in 16 feet of water on the Canadian side of the river, and shows the width of the navigable channel west of the Buffalo Waterworks crib.

Buoy.—A red nun buoy (Fort Erie Point buoy) is moored in 19 feet of water, 1½ (1¾) miles N. by W. ½ W. of Buffalo Breakwater light.

LIGHTS.

Buffalo.—On the south pier, 342 feet from the outer end, from an octagonal gray tower, is shown, 74 feet above the lake level, a fixed white light, visible 14⅓ (16½) miles.

Buffalo Breakwater.—On a crib behind the north end of the breakwater, from a square white structure, is shown, 41½ feet above the lake level, a fixed red light, visible 11¼ (13) miles.

Fog Signal.—On the same crib is a brown fog-signal house alongside the lighthouse. The fog signal is a steam whistle, which sounds as follows: Blast 3 seconds, silent interval 57 seconds. If the whistle becomes disabled a bell is struck by machinery, a treble blow every 30 seconds.

Horseshoe Reef.—In 6 feet of water, on Horseshoe Reef (south end of Middle Reef), from a square white beacon, on a masonry pier, is shown, 44½ feet above the lake level, a fixed white light, varied by a white flash every 90 seconds. The light is visible 12⅛ (14) miles.

Note.—The Buffalo Waterworks Inlet pier, on the east side of the channel at the head of the "Narrows" of the Niagara River, is marked at night by a red light 22 feet above the water. One and a half miles below the Inlet pier the river is spanned by the International Railway bridge, the draw of which is marked at night by a stationary red light on each end of the drawpiers, low down on the free end of each protection pier, and on each side of the pivot pier, where it is crossed by the axis of the bridge. Three square lanterns, each 15 feet above the top of the drawspan, mark its ends and middle, and show red up and down stream when the draw is closed;

but when the draw is open the lanterns show three green lights in line up and down stream, with the stationary low red lights making the width of the openings.

NIAGARA RIVER RANGE.

Front.—On the berm bank of the Erie Canal, nearly abreast of the waterworks pier, from a square, white, pyramidal, open framework, upper part inclosed, is shown, 54½ feet above the lake level, a fixed white light.

Rear.—At 1,200 feet NNE. ⅝ E. (N. 29° 31′ E.) from the front light, from a brown, triangular, skeleton pyramid, with a small house, 15 feet above the ground, surmounted by a circular gridiron day mark of slats, alternately black and white, is shown, 102 feet above the lake level, a fixed white light.

These lights in line lead through the shoals at the entrance of the river in the deepest water.

Caution.—Southwest gales raise the water in Buffalo Harbor from 3 to 6 feet, and gales from the opposite direction lower it as much.

Life Saving Station.—A Life Saving station adjoins Buffalo lighthouse.

Current.—Inside the breakwater the current sets along the shore to the northward 2 miles per hour.

Directions.—Vessels should run in with the Buffalo Breakwater light, bearing ENE. (N. 67° 30′ E.); the north end of the breakwater may be rounded close-to. Then head in for the piers of Buffalo Creek, allowing for the northerly current, or round-to in the outer harbor behind the breakwater.

Emerald Channel lies between Middle Reef on the west, Bird Island Reef on the north, and Horseshoe Reef on the east. The channel should only be attempted by light draft vessels. The current sets strongly across it.

Niagara River is the natural outlet from Lake Erie to Lake Ontario. Its width north of the waterworks crib is 1,900 feet, and its greatest depth 48 feet. At this point the normal current is 5½ miles an hour, the extreme variation in the level of the river when uninfluenced by the wind being but 2 feet. During SW. gales the water rises as much as 4 feet in a few hours, and at such times the current attains a velocity of 12 miles an hour.

Two miles north of the International Railway bridge the river is divided into two arms, Tonawanda Channel to the right and Chippewa Channel to the left. Beyond Grand Island the river descends to the Falls. Chippewa is just at the junction of the two arms on the Canadian side, a little beyond Navy Island.

The Horseshoe Reef Channel was in good condition on May 20, 1895, with a full depth of 16 feet at mean lake level. At that time a dredge was

engaged in cleaning up the low ridges left from the dredging operations of the past 3 years, which work was expected to occupy some weeks.

When passing this reef the ranges should be followed as far as the red can buoy *only*. From this point vessels should head to the west of the inlet pier or waterworks crib and pass that between 300 and 500 feet distant, keeping to the westward; if they are closer than that, they might strike a shoal with 15½ feet on it, some hundred yards or so below the crib.

When opposite the ferry landing on the Canadian shore (but not before reaching this point), they should head for the upper buoy of the bridge channel.

In going down Strawberry Channel, the best way will be found about 50 feet from the 3 black spar buoys. The last rock in this channel is now being removed, and it is being deepened. A dredge engaged in this work is instructed to denote to approaching vessels, by whistle signal, on which side of the dredge they are to pass.

Black Rock Harbor is a canal 3 (3½) miles long and from 100 to 800 feet wide, formed along the river from Buffalo to Square Island, and a pier extending from its lake end. The canal is used only by light draft vessels to avoid the strong current of the narrows. Seven feet can be carried through. There are no dangers.

Chippewa Channel is 8⅝ (10) miles long, and from 650 to 1,150 yards broad, except at Navy Island, where it is contracted to 450 yards. There is a good channel on either side of Navy Island. Using the channel to the right, keep the Navy Island shore aboard to avoid the shoal extending from the NW. point of Grand Island. Both shores of Chippewa Channel are bold, and there are the following unmarked dangers:

A rock a few feet under water lies 250 feet from the Canadian shore with the SE. point of Grand Island bearing N. ¼ E. (N. 2° 48′ E.) distant 850 yards.

A shoal makes out one-fourth the way across the river from the point of the Canadian shore, just below Beaver Island.

A reef, 3 feet under water and 400 yards long, lies 300 yards from the SW. shore of Grand Island nearly opposite Black Creek.

This channel is rarely used except by excursion steamers. The current is from 3 to 4 miles per hour.

Tonawanda Channel lies on the east side of Grand, Strawberry, and Frog islands. Length 7 (8) miles from the point of Strawberry Island to Tonawanda Island; its breadth is from 350 to 1,000 yards. It is not safe to attempt to carry more than 12 feet between Grand and Tonawanda islands. The best water is on the Grand Island side. It is contemplated dredging a channel 18 feet deep from Lake Erie to the north end of Tonawanda Harbor. The current is from 3 to 5 miles per hour, depending on the width of the channel.

Buoys.—Red and black buoys mark parts of the channel, and there is a red and black horizontal-striped spar buoy on Iron Works Shoal off Tonawanda. Strangers should always employ a pilot.

Tonawanda to Niagara Falls.—In the American channel from Tonawanda to Schlosser Docks, vessels of 12 feet draft can navigate with the aid of a pilot. The harbor inside Connors Island, and opposite Schlosser docks is being improved; this harbor is 500 feet wide and nearly ½ mile long.

There are 10 spar buoys (private) placed to mark bars and shoals near Niagara Falls.

The current in the river abreast Connors Island harbor is 1⅜ miles per hour.

The captains of the tugs are the only pilots.

ERIE CANAL.

The Erie Canal connects Lake Erie with the Hudson River at Troy and Albany, and with Lake Ontario at Oswego. Distance to Albany by canal is 351 statute miles, 7-foot depth, 72 locks, length of locks 110 feet.

CHAPTER V.

CANADIAN COAST OF LAKE ERIE.

NOTE.—The Canadian shore of Lake Erie is described from British Admiralty Charts Nos. 332 and 490. The routes given are taken from United States Lake Survey Chart No. 75.

Table of Directions and Distances between Light Stations on the North and South Shores of the Lake. The Outer Pier Lights are taken.

Stations.	Directions.	Nautical miles.	Statute miles.
Pelée Spit to Cedar Point, Sandusky	S. 20° W.	24 1/10	27 3/4
Black River	S. 31 1/2° E.	27 1/2	31 2/3
Cleveland	S. 58 3/4° E.	41 2/3	48
Fairport	S. 83 1/4° E.	55 8/10	64
Ashtabula	N. 88° E.	76 2/3	88 1/4
Presque Isle, Erie	N. 80 3/4° E.	108 1/2	125
Dunkirk	N. 75 1/4° E.	145 1/2	167 1/2
Rondeau Harbor to Cedar Point, Sandusky	S. 36 3/4° W.	57	65 2/3
Black River	S. 14° W.	47 3/4	55
Cleveland	S. 12 1/4° E.	45 1/2	52 1/3
Fairport	S. 45° E.	41 1/4	47 1/2
Ashtabula	S. 67 3/4° E.	54 1/2	62 3/4
Presque Isle, Erie	S. 86 1/2° E.	81	93 1/3
Port Stanley to Cedar Point, Sandusky	S. 43° W.	95 1/2	110
Black River	S. 30 3/4° W.	82 1/2	95
Cleveland	S. 17 1/4° W.	71 2/3	82 1/2
Fairport	S. 2 3/4° W.	53 4/10	61 1/2
Ashtabula	S. 23° E.	48 4/10	55 3/4
Presque Isle, Erie	S. 59° E.	57 8/10	66
Long Point to Cedar Point, Sandusky	S. 61 1/2° W.	133 1/2	153 3/4
Black River	S. 55 3/4° W.	105 3/4	121 3/4
Cleveland	S. 49 1/2° W.	96 4/10	111
Fairport	S. 49 1/4° W.	71 2/3	82 1/2
Ashtabula	S. 40 1/2° W.	50 4/10	58
Presque Isle, Erie	S. 6 1/2° W.	23	26 1/2
Dunkirk	S. 84° E.	31 1/4	36
Port Dover to Dunkirk	S. 64 3/4° E.	41 2/3	48
Port Maitland to Presque Isle, Erie	S. 29 1/2° W.	47 1/2	54 2/3
Dunkirk	S. 24 1/4° E.	23 9/10	27 1/2
Port Colborne to Fairport	S. 53 1/2° W.	111 6/10	128 1/2
Ashtabula	S. 49 1/2° W.	89 1/4	102 3/4
Presque Isle, Erie	S. 41 3/4° W.	56 9/10	65 1/2
Dunkirk	S. 11° W.	23	26 1/2

Routes from the Detroit River (Bar Point) light to the principal Canadian ports:

It is best in all cases to stand down the channel on the east side of the lighthouse and take departure from a point ½ mile SE. of the Detroit River (Bar Point) light.

Detroit River to Kingsville and Leamington.—From the point of departure an ESE. ⅝ E. (S. 74° 31′ E.) course for 11½ (13¼) miles will take a vessel a mile off Colchester Reef lighthouse, with the lighthouse abeam. From this point—

To Kingsville the course is NE. by E. ¼ E. (N. 59° 03′ E.) and the distance 8¼ (9½) miles.

To Leamington the course is ENE. ⅛ E. (N. 68° 54′ E.) and the distance 13 (15) miles.

Detroit River to Pointe Pelée and Ports on the North Shore of the Lake.—From a mile north of Colchester Reef light abeam an ESE. ⅜ E. (S. 71° 43′ E.) course for 14 1/10 (16¼) miles should take a vessel to a point with Pelée Island light bearing SW. and the Dummy light east. Here change course to SE. ¾ E. (S. 53° 26′ E.) for 7 (8) miles, when the Dummy should bear NNW. ½ W. (N. 28° 07′ W.), distant 4¾ (5½) miles, the point of departure for all ports on the lake. Or, with the wind fresh from the southward, an ESE. (S. 67° 30′ E.) course from off Detroit River (Bar Point) lightvessel for 11¼ (13) miles will take a vessel a mile south of Colchester Reef light abeam. Here shape course ESE. ⅞ E. (S. 77° 20′ E.) for 14⅓ (16½) miles, to the point designated above, NE. of Pelée Island light and west of the Dummy.

From the Point of Departure off Pelée Spit Lighthouse—

To Rondeau Harbor.—Steer NE. ¼ N. (N. 42° 11′ E.) for 35 4/10 (40¾) miles; this course will take a vessel off Rondeau Harbor light, at the entrance to the harbor.

To Port Stanley.—Steer NE. ¼ E. (N. 47° 48′ E.) for 74½ (85¾) miles; this course will take a vessel off Port Stanley light.

To Port Bruce.—Steer NE. ⅝ E. (N. 52° 01′ E.) for 81 2/10 (93½) miles; this course will take a vessel off Port Bruce light.

To Port Burwell.—Steer NE. by E. (N. 56° 15′ E.) for 88 1/10 (101½) miles; this course will take a vessel off Port Burwell light.

To Long Point.—From point of departure off Pelée Spit lighthouse, ENE. ⅛ E. (N. 68° 54′ E.) for 115½ (133) miles, will take a vessel 1¾ (2) miles south of Long Point lighthouse. At this point a new departure must be taken for the different ports in the NE. part of the lake.

To Port Dover.—Round Long Point at about 2 miles, and when it bears west steer NNW. ⅝ W. (N. 29° 31′ W.) for 16½ (19) miles; this will take a vessel off Port Dover lighthouse.

To Port Maitland.—From south of Long Point, NE. ⅛ E. (N. 46° 24′ E.) for 28¼ (32½) miles, will take a vessel off Port Maitland light.

To Port Colborne and the Welland Canal.—From south of Long Point, NE. by E. ¼ E. (N. 59° 03′ E.) for 40⅛ (46½) miles, will take a vessel off Port Colborne lights, at the entrance to Welland Canal.

NORTH SHORE.

Bar Point to Colchester.—From Bar Point the coast trends about SE. by E. 8⅛ (10¼) miles to Little Point, at Colchester, and forms the NE. entrance shore of the Detroit River. Leaving the river, shoal water is found some distance from the shore, the immediate entrance to the river being shoal, except in the channel. As Colchester is approached, the shoals close in on the shore, and at Colchester extend only ⅛ mile off.

Grecian Shoals.—Several shoals, least water 12 feet, lie about a mile off Colchester pier, with deep water between the shoals and shore.

Colchester Reef and Light, see page 23.

Colchester to Kingsville.—At Little Point the coast line changes direction to about ENE. for 9⅛ (10¾) miles to Kingsville. Shoals extend ⅛ mile from shore, widening out to over ½ mile before reaching Kingsville harbor.

KINGSVILLE RANGE LIGHTS.

Front.—On the outer end of the east breakwater pier, from a lantern on a pole, is shown, 27 feet above the lake level, a fixed red light, visible 5 (5¾) miles.

Rear.—On the top of a bank at the head of the east pier, 1,060 feet N. by W. (N. 11° 15′ W.) of the front light, from a white, square lighthouse, lantern red, is shown 55 feet above the lake level a fixed white light, visible 12 (13¾) miles.

These lights in line N. by W. (N. 11° 15′ W.) lead to the entrance of Kingsville harbor. Leave the red light to starboard in entering.

Kingsville to Leamington.—Leamington lighthouse is 6 (7) miles east of Kingsville lighthouse, with Ruthven dock about midway between. After leaving Kingsville, the shore can be approached to ½ mile.

Leamington Light.—On the shore, near the pier, from a white square tower, is shown, 48 feet above the lake level, a fixed white light, visible 12 (13¾) miles.

Shoal.—South of the light and on the east side of the pier is a shoal running out about 1,200 feet, with 4 feet over it.

Leamington to Pointe Pelée.—At Leamington the coast line changes direction to the southward, and so continues 8⅜ (10) miles to the south end of Pointe Pelée. This whole stretch is steep-to, the 3-fathom line following the coast about 1,000 feet off.

Pointe Pelée, a narrow, sharp point, extends southward into the lake for a distance of about $8\frac{6}{10}$ (10) miles.

Excellent anchorage in 5 fathoms mud may be had behind the point, with shelter from easterly and northeasterly winds. The eastern side of the point also affords anchorage in 5 fathoms, with shelter from westerly and northwesterly winds. Shoals extend from this side of the point $\frac{1}{3}$ mile.

Pointe Pelee Spit extends south from the point $1\frac{7}{8}$ ($2\frac{1}{8}$) miles; it curves to the eastward towards its southern part and then to the westward, thus forming a hook. The northern part of the spit is $\frac{1}{2}$ mile broad, with but 2 feet water on it one mile from the point. Near the south end of the spit, the Dummy has only one foot over it. Eastward of the Dummy about $1\frac{3}{4}$ (2) miles are several shoal spots, least water 15 feet, with a clear channel between, but this channel should not be attempted. Pelée Spit lighthouse, bearing NW. by W. (N. 56° 15′ W.) clears these shoals to the southward.

Wrecks.—The wreck of the *Wind and Wave* lies in 30 feet water nearly $1\frac{1}{3}$ ($1\frac{1}{2}$) miles NE. by E. $\frac{1}{2}$ E. (N. 61° 52′ E.) from Pointe Pelée light.

The wreck of the *Walter H. Oads* lies in 17 feet water one ($1\frac{1}{4}$) mile ESE. (S. 67° 30′ E.) from the same light.

The wreck of the *David Vance* lies in 40 feet water $1\frac{1}{3}$ ($1\frac{1}{2}$) miles SW. by W. (S. 56° 15′ W.) of the light. Soundings of 19 feet have been obtained over this wreck and, as it lies almost in the track of passing vessels, great caution should be observed when in this locality.

Southeast Shoal.—SE. $\frac{3}{8}$ S. (S. 40° 46′ E.) $2\frac{9}{10}$ ($3\frac{1}{3}$) miles from the Dummy light is the center of a large shoal, with a least depth of 13 feet (at lowest lake level). From this spot, as a center, shoal water extends in all directions for nearly $\frac{3}{4}$ mile. Between Southeast Shoal and the Dummy are several 15 and 18 foot spots, and it is not safe for vessels to pass north of the shoal.

Grubb Reef consists of several 12 and 16 foot rocky patches, lying from $1\frac{3}{4}$ (2) to $2\frac{6}{10}$ (3) miles WNW. of Pelée Spit lighthouse, with deep water between. The reef has extended to the eastward for a mile, with a least depth of 16 feet. This lighthouse, bearing east, leads well clear of the shoals to the southward.

Rocky Shoal.—About midway between Grubb Reef and the Middle Ground is a rocky shoal $\frac{1}{3}$ mile in diameter, within the 5-fathom line, with a least depth of 17 feet.

Pelée Spit (the Dummy) Light.—On a caisson, about $1\frac{3}{4}$ (2) miles south from the extreme end of Pointe Pelée, from a white, octagonal lighthouse, on a steel-faced pier, is shown, 76 feet above the lake level, a white light, revolving every $1\frac{1}{2}$ minutes, and visible 15 ($17\frac{1}{4}$) miles.

Fog Signal.—A steam horn sounds blasts of 7 seconds duration, with silent intervals of 45 seconds.

Pointe Pelée to Rondeau Harbor.—The east coast of Pointe Pelée trends north 12½ (14) miles to Muddy Creek and Two Creeks; it then changes direction to the NE. by E. ½ E. for 26 (30) miles to Rondeau Harbor.

Rondeau Harbor is a small natural harbor, suitable for very light draft vessels. The entrance is protected by breakwaters and piers, but inside the harbor is quite shallow. The eastern side of the harbor is protected by Pointe aux Pins.

Current.—Southeast gales raise the water considerably in this harbor. With SW. gales the waters run out in a very strong current, and, at such times, it is dangerous for vessels to be in the harbor.

RANGE LIGHTS.

Front.—On a crib-work block, on the outer end of the east pier, from a white, square, open framework, is shown, 34 feet above the lake level, a fixed white light, visible 11 (12¾) miles. This light is visible only over a small arc on each side of the alignment.

Rear.—At 780 yards N. by E. ⅜ E. (N. 15° 28′ E.) from the front light is shown, 70 feet above the lake level, a red and white light, alternating every 1½ minutes. The light is visible 14 (16½) miles.

The alignment of these lights leads to the entrance, and the lights must be left to starboard on entering.

Pointe aux Pins to the West End of Long Point Island.—The west point of Long Point Island is ENE. ½ E. 67¾ (78) miles from Pointe aux Pins, the coast line between first trending NE. to Port Stanley, and then E. by S. forms an open bight with Port Stanley at its head. Many rivers and creeks empty into the lake along this stretch of the coast.

Port Stanley Light.—On the west pier head, from a white, square lighthouse, 42 feet above the lake level, is shown a fixed white light, visible 11 (12¾) miles.

Port Burwell.—A bar has formed across the mouth of the harbor, which has shoaled the water to 8 feet.

Port Bruce.—A fixed white light is shown on a pole at Port Bruce. This light is a private light and not under the control of the Marine Department of Canada.

Port Burwell Light.—Three hundred and thirty-three yards inshore, from an octagonal lighthouse, 96 feet above the lake level, is shown a fixed white light, visible 15 (17¼) miles.

Long Point Island, formerly Long Point, is a long, narrow island projecting eastward nearly 20 miles from the main shore. It is over 1¼ (2) miles wide at Bluff Point, the northeastern point of the island; and

from Bluff Point tapers to its eastern sharp extremity, Long Point. At Pottohawk Point, the NW. point, it is $2\frac{6}{10}$ (3) miles wide and then tapers to the west end of the island, leaving a small bight partially filled with shoals between the NW. and NE. points. All the southern shore can be approached to $\frac{3}{4}$ mile, but from Long Point west, on the north shore, the shoals gradually widen out until Bluff Point is reached, where they extend northeasterly for $2\frac{6}{10}$ (3) miles, leaving a little clear water between the outer end of the spit and the shoals, which border the island. At Pottohawk Point the shoals again approach the shore, and between this point and the mainland to the north is the eastern entrance to Inner Bay, protected on the NW. by the mainland and on the SE. by Long Point Island. The southern entrance to Inner Bay is between the island and the mainland, but it is narrow, and is reported as having silted up. The bay is fit only for very small craft. Port Rowan is on its western shore. The deepest water in Lake Erie is found south and east of Long Point.

LIGHTS.

West End of Long Point.—On the east side of the new channel, from a square, white tower, dwelling attached, is shown, 52 feet above the lake level, a red light, revolving every minute. The light is visible from all points seaward a distance of 12 ($13\frac{1}{2}$) miles.

When a lifeboat is required at this station the light is obscured toward Port Rowan.

Long Point.—On the eastern extremity, from an octagonal lighthouse, 65 feet above the lake level, is shown a white light, revolving every minute, visible 13 (15) miles.

Fog Signal.—The fog signal building, white, is 200 yards south of the light. The signal, a steam horn, sounds blasts of 7 seconds duration, with silent intervals of 30 seconds.

Outer Bay of Long Point.—North of Long Point, between the island and the main shore, Outer Bay is $14\frac{3}{4}$ (17) miles wide and, from this line, 13 (15) miles deep to its western shore. The bay affords excellent anchorage, and is protected from all winds from south to north by way of west.

Port Dover is on the NW. shore of Outer Bay. The harbor is at the mouth of the Lynn River, having 2 parallel piers, each about 1,000 feet long. Depth of water at end of pier 12 feet; inside the harbor 8 feet. There are no pilots.

Reefs.—A reef $1\frac{3}{4}$ (2) miles long, with 3 feet of water over it, lies about one mile off shore.

A reef lies one mile SE. of Port Dover lighthouse and is about $\frac{3}{4}$ mile from shore. Between the reef and the shore there are, in places, from 12 to 14 feet, but there is no safe passage for vessels on account of

bowlders. Outside of the reef, 100 yards, the water is from 15 to 25 feet deep.

Port Charges.—Vessels over 100 tons, fifty cents per day; under 100 tons, twenty-five cents per day.

Light.—On the west pier, from a white, hexagonal lighthouse, 20 feet above the lake level, is shown a fixed white light, visible 8 (9¼) miles.

Nanticoke Shoal, with 7 feet water, lies S. 66° 05′ W., 4⅞ (5 6/10) miles from Peacock Point and 11¼ (13) miles N. 2° 40′ W. from the east end of Long Point. The spot is a small rocky ledge and under a depth of 18 feet is ½ mile long NW. and SE. by ¼ mile wide, the shoalest spot being in the middle.

When in this vicinity, vessels should not shoal to less than 8 fathoms.

Port Dover to Port Maitland.—The coast trends easterly for 27¾ (32) miles with several small projecting points.

Tecumseh Shoal.—To the westward of Grand River Bluff and (reported as lying) from 3 to 8 statute miles off shore is Tecumseh Shoal, which extends westward and parallel with the shore for several miles. At low water, rocks on the shoal uncover. This shoal is charted about 3 miles off shore and the same distance in extent east and west; it is probable that it is of larger size and farther off shore. When in this locality, Port Maitland light should be kept well open of Hydes Point, the first point west of Port Maitland, to clear the east end of Tecumseh Shoal.

Port Maitland is on the Grand River, at the head of a small bight, to the eastward of Grand River Bluff.

Light.—On the west pier at Grand River entrance, from a white, open frame, 51 feet above the lake level, is shown a fixed white light, visible 10 (11½) miles.

Mohawk Bay, a small dip in the coast line, is just eastward of Port Maitland, and between Barbed and Selkirk points. Barbed Point is surrounded by a rocky reef which extends to the southward nearly ¼ mile.

Mohawk Island, about 400 yards in diameter, lies in the center of the bay and outside the line joining the points; it is surrounded by rocks; shoals extending nearly a mile southeasterly, on which are many rocks. This shoal has a breadth of over ½ mile.

Anchorage.—There is deep water, clay bottom, midway between Mohawk Island and Barbed Point, which affords anchorage in winds from west to east by way of north.

Mohawk Island Light.—On the island, from a white, circular lighthouse, is shown, 64 feet above the lake level, a white revolving light, showing 3 flashes at intervals of 30 seconds, followed by an eclipse of 75 seconds. A complete revolution is made in 2¼ minutes. The light is visible 10 (11½) miles.

Mohawk Bay to Niagara River.—Between Selkirk Point and Morgans Point, 6 (7) miles to the eastward, is Moulton Bay, open to the southward. E. by S. 11 (12¾) miles from Morgans Point is Abino Point; the coast between projecting in small points, has several bights open to the southward; from all these points shoals extend off some distance. Sugarloaf Point, the west point of Gravel Bay on which is Port Colborne, is surrounded with shoals, and the east point of this bay has shoals extending off a mile, the bay being filled with shoals. Windmill Point is 4⅓ (5) miles NE. of Abino Point, with two bights filled with shoals between. From Windmill Point to the mouth of the Niagara River shoals line the coast, and Windmill Point should be given a berth of 1¼ (1½) miles. The coast may be approached somewhat nearer as the river entrance is neared.

Waverly Shoal lies off this portion of the coast, the NE. end lying 2 ($2\frac{3}{16}$) miles SW. by W. ⅜ W. (S. 63° 16′ W.) from the light on the Buffalo Breakwater. The shoal is 100 feet wide and extends 700 yards SW. and NE., least water 12 feet, 400 feet SW. of the buoy. There is a 16-foot spot a little eastward of the north end of the shoal, and an 18-foot spot in line with the buoy and breakwater light, and ¾ mile from the latter.

Buoy.—A red and black, horizontally-striped, can buoy is moored in 13 feet of water near the NE. end of the shoal.

Port Colborne is at the entrance of the Welland Canal. The entrance to the harbor has been improved by piers.

Beacon.—A vertically-striped red and white beacon, surmounted by a globe, stands on the outermost crib of the east pier.

Main Light.—On the head of the west pier from a white, octagonal tower, on a brown, cylindrical base, surmounted by a red lantern, is shown 70 feet above the lake level, a fixed white light, visible 14 (16⅛) miles.

Crib Light.—On a crib, east side of the entrance, 2,030 feet N. by E. ⅛ E. (N. 12° 22′ E.) of the main light, is shown 35 feet above the lake level, a fixed red light visible 8 (9¼) miles.

Fog Signal.—At the Main Light Station, a fog horn sounds blasts of 11 seconds every 1½ minutes.

Shoal.—A bar runs across from the east to the west pier.

Sixteen feet may be carried to within 100 feet of the south end of the east unbroken pier, but inside scant 15 feet will be found.

There is a sand spit making out southwesterly from the south end of this pier (continuous part); and 100 feet distant there is but 13 feet at the edge of the track.

The deepest water track is very narrow, and a vessel only her own width out of it will, in all probability, find one foot less water.

In the above remarks it is assumed that there are 14 feet on the dock sill, with a liability of a change of one foot either way.

Directions.—The alignment of the lights N. by E. $\frac{1}{8}$ E. (N. 12° 22′ E.) gives the deepest water entering the canal, and clear of Sugarloaf Reef. The main light must be left to port and the crib light to starboard in entering. The main light is visible from all points seaward; the crib light is visible in the line of range and into the harbor.

Welland Canal.—The canal flanks the Niagara River, and is 26$\frac{3}{4}$ miles in length from Port Colborne to Port Dalhousie. Its dimensions are as follows: Number of lift locks, 25 (270 by 45 feet); total rise of lockage, 326$\frac{3}{4}$ feet; depth of water on the sills, 14 feet. Thirteen feet can be carried through at present. There are two pairs of guard gates and one guard lock.

CHAPTER VI.

LAKE ONTARIO.

(United States Lake Survey Charts, Nos. 60 and 61.)

Lake Ontario is the eastern and smallest of the Great Lakes. The length of the lake between Sacketts Harbor and Burlington Bay lights is 165 (190) miles, and its greatest breadth $46\frac{9}{10}$ (54) miles; its maximum depth 738 feet, and its elevation above the sea 246.61 feet.

Its basin drains 29,760 square miles, including the lake surface of 7,240 square miles.

By reason of its greater depth, the surface of Lake Ontario is less disturbed by storms than Lake Erie. It is much less obstructed by ice, the lake never freezing except near the shore, and navigation is rarely interrupted.

The chief tributaries are the Niagara, Genesee, and Oswego rivers on the south shore, and the Trent on the north shore.

The south shore of the lake from the Niagara River east to the St. Lawrence is in the State of New York.

All of the north and west shores and the south shore from the Niagara River west, is in the Province of Ontario, Canada.

NAVIGATION.

The two great evils to navigation are fog and snow.

There are no tides and but light currents for the master to contend with on the lake, and as these are the most uncertain of all elements for the navigator to calculate and allow for, it reduces very much the percentage of danger in lake navigation; hence the safe navigation of the lake is confined to a correct compass, with a knowledge and frequent use on the part of the master of the azimuth tables, the precaution to take cross-bearings of prominent points, and from them plotting the position frequently on the chart; also the familiar use of the chart in laying courses and correcting the same for variation and deviation.

DANGERS.

With the exception of the shoals among the islands at the NE. end, Lake Ontario is remarkably free from outlying dangers. Off the mouth of the Niagara River are several offlying shoals known as the Niagara Bar

They are not only in the course of vessels entering and leaving Niagara river, but also are a menace to all vessels bound to or from the Welland Canal and the lower lake ports. On the west coast of the lake, south of Port Credit, is an offlying shoal, the position of which is not well determined. Off Shoal Bay and Prince Edward Island, on the north coast, are several offlying shoals. There are several shoals SE. of False Duck lighthouse. From Calf Island a spit extends SW. for 1½ (1¾) miles, with only 10 feet on it; Charity shoal, with 5 feet over it, lies 2 6/10 (3) miles SE. of Pigeon Island. Big Bar shoal, south of Amherst Island, and an extensive shoal, with 4 feet over it, lying WSW. from Snake Island light, are the principal shoals in the NE. end of the lake.

ROUTES.

Welland Canal to the United States Ports.—From the point of departure, off the Welland Canal, 3½ (4) miles north of Port Dalhousie outer light—

To Niagara River.—ENE. ¼ E. (N. 70° 18′ E.) for 9½ (11) miles should take a vessel 3½ (4) miles north of Fort Niagara light, when change course for Fort Massassauga and stand for it S. by W. (S. 11° 15′ W.) When Fort Niagara light bears SE. ¾ E. (S. 53° 26′ E.) head in for it on this bearing, passing SW. of the black spar buoy on Fort Niagara shoal, and shape a mid-channel (between the forts) course up the river.

To Wilson Harbor.—From 3½ (4) miles north of Fort Niagara light E. ⅞ N. (N. 80° 09′ E.) for 10 (11½) miles should take a vessel off the entrance to Wilson Harbor.

To Olcott Harbor.—From 3½ (4) miles north of Fort Niagara light E. ⅞ N. (N. 80° 09′ E.) for 15 (17¼) miles should take a vessel off the entrance to Olcott Harbor.

To Thirty-Mile Point.—Continuing this last course for 10½ (12) miles, should take a vessel one mile north of Thirty-Mile Point; or from the point of departure off the Welland Canal ENE. ¼ E. (N. 70° 18′ E.) for 34½ (39¾) miles, should take a vessel 5 (5¾) miles N. by W. ⅞ W. (N. 21° 05′ W.) of Thirty-Mile Point. This position is used as a point of departure for the ports to the eastward on the south shore of the lake.

To Oak Orchard Harbor (Carlton).—From this point of departure ESE. ¾ E. (S. 75° 56′ E.) for 15 (17¼) miles should take a vessel off Oak Orchard light.

To Charlotte Harbor and Great Sodus Bay.—From 5 (5¾) miles off Thirty-Mile Point E. ⅜ S. (S. 85° 46′ E.) for 37½ (43⅛) miles, should take a vessel 9½ (11) miles N. by E. ¾ E. (N. 19° 41′ E.) of Genesee Light; whence SSE. ¼ E. (S. 25° 18′ E.) for 9 (10½) miles, should take a vessel off Charlotte; and ESE. ⅞ E. (S. 77° 20′ E.) for 31¼ (36) miles, should take a vessel off the entrance to Great Sodus Bay.

To Fair Haven.—From 5 (5¾) miles north of Thirty-Mile Point E. ⅜ S. (S. 85° 46′ E.) for 80 (92⅛) miles should take a vessel off Fair Haven range lights.

To Oswego.—From 5 (5¾) miles north of Thirty-Mile Point E. ⅛ N. (N. 88° 35′ E.) for 88 (101⅓) miles should take a vessel off Oswego harbor.

To Sacketts Harbor.—From 5 (5¾) miles off Thirty Mile Point, ENE. ¾ E. (N. 75° 56′ E.) for 97 (111¾) miles should take a vessel 3½ (4) miles west of Stony Point lighthouse, whence NE by E. (N. 56° 15′ E.) for 12⅛ (14) miles should take a vessel ½ mile north of Sacketts Harbor lighthouse.

To Cape Vincent.—From 3½ (4) miles north of Port Dalhousie outer light steer ENE. ¼ E. (N. 70° 18′ E), for 9½ (11) miles when Fort Niagara light should bear south, change course to ENE. ⅜ E. (N. 71° 43′ E.) for 120 (138) miles, when Galloo Island lighthouse should bear abeam, distant 2 (2¼) miles; here change course to N. by E. ½ E. (N. 16° 52′ E.) for 11½ (13¼) miles, which should take a vessel ¾ miles west of Tibbets Point lighthouse, from here to the anchorage off Cape Vincent keep about ⅓ mile off shore.

WELLAND CANAL TO CANADIAN PORTS.

From one (1¼) mile north of Port Dalhousie outer light—

To Burlington Bay (Hamilton).—WNW. ⅛ W (N. 77° 20′ W.) for 23 (26½) miles should take a vessel off Burlington Bay range lights.

To Toronto.—N. by W. ½ W. (N. 16° 52′ W.) for 23½ (27) miles should take a vessel off Gibralter (Lighthouse Point) light.

To Coburg.—NE. ⅜ E. (N. 49° 13′ E.) for 63 4/10 (73) miles should take a vessel off Coburg lights.

To Presqu' Ile Harbor.—From 3½ (4) miles north of Port Dalhousie outer light NE. by E. ⅜ E. (N. 60° 28′ E.) for 80⅓ (92½) miles should take a vessel 2 (2¼) miles south of Presque Isle light.

To Kingston.—From 3½ (4) miles north of Port Dalhousie outer light ENE. ¼ E. (N. 70° 18′ E.) for 113⅓ (130½) miles should take a vessel 3½ (4) miles south of False Duck light (United States Lake Survey Chart No. 60); continue this course for 5 (5¾) miles when False Duck light should bear WNW. (N. 67° 30′ W.), and a vessel will be clear to the eastward of Harris Shoal; at this point change course to N. by E. ⅝ E. (N. 18° 16′ E.) for 17¾ (20½) miles, when Snake Island light should be abeam; this course passes within a mile of Nine-Mile (Gage) Point lighthouse and between the two unmarked shoals north of it. Do not pass east of a line joining Nine-Mile (Gage) Point and Pigeon Island lights until close up to Snake Island light. Continue N. by E. ⅝ E. (N. 18° 16′ E.) from abeam of Snake Island light for ⅞ mile, or until this light bears SSE. ⅝ E. (S. 29° 31′ E.) and Center Brother Island light bears W. ¼ N. (N. 87° 11′ W.), when change course to ENE. ¼ E. (N. 70° 18′ E.) and run along the shore, keeping not

more than ¼ mile off to avoid the two 12-foot patches off Kingston, which should be kept to starboard if unmarked.

Vessels of 15 feet draft may pass between Simcoe and Snake islands. The channel is buoyed on the east side of Snake Island, and by keeping the Snake Island buoy close aboard, or leaving two-thirds of the passage to the eastward you can, by steering to the northward slowly as you pass Snake Island, keep good water; but you can not, with a vessel drawing over 11 feet, steer straight for Kingston when abreast of Snake Island.

Caution.—Unless a vessel is well satisfied of her position, the above directions should be used with caution, as the two unmarked shoals SW. of Snake Island lie close to the track.

CHAPTER VII.

UNITED STATES COAST OF LAKE ONTARIO.

(United States Lake Survey Charts Nos. 60 and 61.)

The United States Coast of Lake Ontario comprises all the shore of the lake from the Niagara River eastward to the town of Cape Vincent.

In the following description the Canadian shore, from the Welland Canal to the Niagara River, will also be considered; as also the coast of Wolfe, or Long Island, from opposite Cape Vincent to Browns Point.

Port Dalhousie, at the Ontario entrance to the Welland Canal, has 2 piers 200 feet apart and 2,000 feet in length, extending about north into the lake. Fourteen feet can be carried between the piers and into the canal, but 13 feet only are allowed at present.

Front Light.—About 26 feet from the outer end of the east pier a fixed white light is shown, 42 feet above the lake level, from a white, square tower. It is visible 11 (12¾) miles.

Main Light.—On the same pier, 324 feet S. ¼ E. (S. 2° 49′ E.) from the outer light, is a white light, revolving every minute. It is shown from a white, circular tower, 55 feet above the lake level, and is visible 12 (13¾) miles. This light shows from east to west through south.

Shoal.—There is an 18-foot detached shoal ¼ mile NNE. ¾ E. of the outer pier light.

Welland Canal to the Niagara River.—The coast trends NE. by E. ½ E. 6¾ (7¾) miles, then changes direction to the eastward for 2¼ (2½) miles to Fort Massassauga, at the mouth of the Niagara River. Shoals border this coast and extend off shore, in places, ¾ mile. Off the mouth of the Niagara River are several offlying patches.

Shoals.—At 2¼ (2½) miles W. by N. of Fort Niagara light is the south end of a detached shoal ⅝ mile off shore, with 16 feet least water, and extending north and south ¾ mile. NNW. 2 6/10 (3) miles from the light is the center of a shoal, 13 feet least water, which extends east and west ¾ mile. Between these two shoals are detached spots with 18, 11, 15, and 16 feet over them. These shoals are known as the Niagara Bar, and are a menace to all vessels bound in or out the river, as well as to vessels bound to or from the Welland Canal and lower lake ports. Not being properly located they are the cause of many disasters.

Bell Buoy.—A bell buoy is moored at the opening of navigation on these shoals, on the Canadian side of the channel, by the Niagara Navigation Company. Its position is not to be entirely relied upon.

Buoy.—On a rocky spit, extending a mile north and NW. from Fort Niagara, is a black spar buoy. It is moored in 14 feet, $\frac{2}{3}$ mile from shore and $\frac{1}{4}$ mile inside the 3-fathom curve.

The water shoals gradually inside the buoy to a depth of 6 feet close to the shore. Abreast the outer face of Fort Niagara a spur of the reef projects a little beyond the range of the buoy and the outer corner of Fort Niagara wharf.

Niagara River.—This river is navigable for 6 (7) miles to Lewiston on the United States shore, and Queenstown on the Canadian shore. Its width is about 500 yards; depth from 4 to 12 fathoms, with muddy or rocky bottom. The banks are bold and high and there are no dangers. Youngstown and Niagara are just within the river mouth on the United States and Canadian shores, respectively.

Current.—At Lewiston the current is about 4 miles an hour, decreasing to 3 miles at the mouth of the river and to $\frac{1}{4}$ mile about 2 miles from shore. The strength of the river current and the depth of water in the mouth of the river and at the west end of the lake, are materially affected by winds blowing up or down the lake; the former wind decreases the current and raises the water, and the latter produces the opposite effect. The difference in level is sometimes as much as 3 feet.

Fort Niagara Light—On the high east bank of the river and $\frac{1}{4}$ mile within its mouth, from a gray, octagonal tower, 79$\frac{1}{2}$ feet above the lake level, is shown a fixed white light, visible 14$\frac{1}{2}$ (16$\frac{3}{4}$) miles. The light is obscured between SE. $\frac{1}{2}$ S. and SE. by S. by a water tank on the military reservation. It is also obscured when bearing about SE., through an arc of a few degrees, by tall trees near the shore.

Directions.—Approach the shore with Fort Niagara light bearing south; when 3$\frac{1}{2}$ (4) miles north of the light bring Fort Massassauga ahead S. by W. (S. 11° 15′ W.) and stand in for it. When $\frac{3}{4}$ mile from the fort keep off a little to the westward to clear the edge of the spit extending from Fort Niagara, and when Fort Niagara light bears SE. $\frac{3}{4}$ E. (S. 53° 26′ E.) stand in for it, passing SW. of the black spar buoy, and shape a mid-channel course up the river.

Niagara River to Wilson Harbor.—The coast trends ENE. $\frac{1}{2}$ E. for 10$\frac{1}{2}$ (12) miles. There is a detached 16-foot spot one (1$\frac{1}{4}$) mile NE. by N. of Fort Niagara, and the water is shoal $\frac{1}{2}$ mile from the shore between these places.

Wilson is at the mouth of Twelve Mile Creek. Wilson Harbor entrance has been improved by 2 piers. The east pier has a length of

850 feet and the west 832 feet. There is also a shore protection of 360 feet for the east pier. There is only a depth of 8½ feet in the channel.

Wilson to Olcott.—The coast continues in the same direction for 5¼ (6) miles and has the same characteristics.

Rock.—A rock is reported as lying about 1¾ (2) miles west of Olcott light station; it extends east and west ½ mile and is the same distance off shore. There are only 4 or 5 feet water on the rock (November, 1895).

Olcott is on Eighteen-Mile Creek. Olcott Harbor has been improved by the building of piers and dredging. The east pier is 850 feet in length, and the west pier 873 feet; width between the piers, 200 feet; direction of piers, N. ⅝ W.

Channel.—Between the piers the channel is 180 feet wide, the limiting lines being 10 feet from the piers, and from the shore end of the piers it decreases to 98 feet in width at the Main Street bridge. Depth in the channel, 13 feet, measured from mean lake level. A sand bar is reported as forming about 60 feet from the piers, with about 6 or 7 feet over it (November, 1895).

Light.—On the west pier, 30 feet from the outer end, is a square pyramidal tower, brown below and white above, exhibiting a fixed white light 30½ feet above the lake level, and visible 10⅞ (12¼) miles.

ROUTES.

Olcott to a position 5 (5¾) miles N. by W. ⅛ W. (N. 21° 05′ W.) of Thirty-Mile Point. From one mile north of Olcott to this point the course is NE. ⅛ N. (N. 35° 09′ E.) and the distance 10¼ (11¾) miles.

From this point the routes to the eastward are described in Chapter VI., under Welland Canal, to—

Olcott to Thirty-Mile Point.—The coast continues nearly ENE. for 10½ (12) miles, and the shoals are somewhat nearer the shore.

Thirty-Mile Point, just westward of Golden Hill Creek, is rounding and only a slight projection from the coast line, and here the coast changes direction to the east.

Light.—On the point, from a square, gray tower rising from the north point of a dwelling, 71½ feet above the lake level, is shown a white light, flashing every 90 seconds, visible 14⅛ (16¼) miles.

Thirty-Mile Point to Oak Orchard Harbor.—Oak Orchard light is 12⅞ (14¾) miles east of Thirty-Mile Point light; the coast between can be approached, to a mile, with safety.

Oak Orchard Harbor (on Oak Orchard Creek) has been improved by the construction of 2 piers, 200 feet apart, extending to the 12-foot curve, and a shore protection to the east pier, 91 feet long. The channel has a depth of 13 feet at mean lake level for its whole width between the piers, excepting 10 feet along each pier. Direction of the piers, N. ⅜ E.

Light.—On the west pier, 27 feet from the outer end, from a square, pyramidal tower, brown below and white above, 29¾ feet above the lake level, is shown a fixed white light, visible 10⅝ (12¼) miles.

Caution.—The shore eastward of Oak Orchard Harbor should not be followed on account of a reef extending 1¾ (2) miles ENE. from the lighthouse.

Directions.—Approaching from the eastward, do not bring the light to bear south of SW. until a mile off shore, when stand in with the lighthouse bearing south.

ROUTES.

From the point of departure, 1¾ (2) miles north of Oak Orchard light—

To Charlotte.—Steer E. ⅜ S. (S. 85° 46′ E.) for 24⅛ (27¾) miles, when Genesee outer light should bear S. by E. ⅜ S. (S. 15° 28′ E.), thence S. by E. ¼ S. (S. 19° 41′ E.) for 6 (7) miles, should take a vessel off the entrance to Charlotte Harbor, with the range lights in line.

To Big Sodus Bay.—E. ⅜ S. (S. 85° 46′ E.) for 53⅞ (62) miles should take a vessel off the entrance to the bay, with the range lights in line.

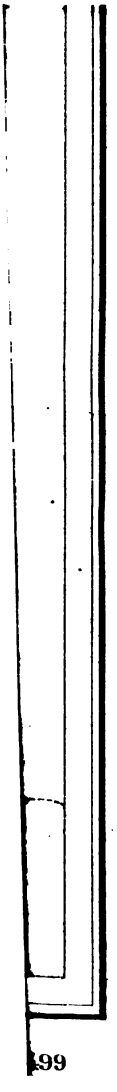
To Fair Haven.—E. ⅛ S. (S. 88° 35′ E.) for 64¼ (74) miles should take a vessel off Fair Haven, with the range lights in line.

To Oswego.—E. ⅜ N. (N. 85° 46′ E.) for 73 (84) miles should take a vessel off Oswego.

To Sacketts Harbor.—ENE. ⅜ E. (N. 71° 43′ E.) for 83 (95½) miles should take a vessel 3½ (4) miles west of Stony Point lighthouse; whence NE. by E. (N. 56° 15′ E.) for 12⅛ (14) miles, should take a vessel ½ mile north of Sacketts Harbor lighthouse.

To Cape Vincent.—ENE. (N. 67° 30′ E.) for 80¾ (93) miles should take a vessel 2 (2¼) miles N. by W. ⅝ W. (N. 18° 16′ W.) of Galloo Island lighthouse; thence N. by E. ½ E. (N. 16° 52′ E.) for 11½ (13¼) miles should take a vessel ¾ mile west of Tibbetts Point lighthouse; from here to the anchorage off Cape Vincent keep about ⅓ mile off shore.

To Kingston.—NE. by E. ¾ E. (N. 64° 41′ E.) for 72⅛ (83) miles should take a vessel 5⅛ (5⅞) miles ESE. (S. 67° 30′ E.) of False Duck lighthouse; whence change course to N. by E. ⅝ E. (N. 18° 16′ E.) for 17¾ (20½) miles, when Snake Island light should be abeam; this course passes within a mile of Nine-Mile (Gage) Point lighthouse and between the two unmarked shoals north of it. Do not pass east of a line joining Nine-Mile (Gage) Point and Pigeon Island lights until close up to Snake Island light. Continue N. by E. ⅝ E. (N. 18° 16′ E.) from abeam of Snake Island light for ⅞ mile, or until Snake Island light bears SSE. ⅝ E. (S. 29° 31′ E.), and Center Brother Island light bears W. ¼ N. (N. 87° 11′ W.), when change course to ENE. ¼ E. (N. 70° 18′ E.) and run along the shore, keeping not more than ¼ mile off to avoid the two 12-foot patches off Kingston, which should be kept to starboard if unmarked. (See caution, page 62.)



Oak Orchard Harbor to Charlotte.—From Oak Orchard Harbor the coast trends east 9½ (10¾) miles to the Devils Nose, a prominent bluff 77 feet high. A rocky spit extends 2 (2¼) miles ENE. from Oak Orchard Harbor, its outer edge being nowhere over ¾ mile from shore; shoals then follow the shore line, at an average distance of about ⅓ mile, until the Devils Nose is reached, where they extend out over ½ mile. At the Devils Nose the coast changes direction a little to the southward for 9½ (11) miles, when it bends again to the southward and trends SE. by S. 2½ (2¾) miles to Braddock Point. Shoals line all this portion of the coast and in places extend off ¾ mile. At Braddock Point the shore changes its character, becoming lower, and between this point and Charlotte Harbor, 6 (7) miles SE., there are several bays and ponds, fronted by shoals, extending off shore over ½ mile.

Charlotte is at the mouth of the Genesee River. Charlotte Harbor is the port of Rochester, which is 1¾ (2) miles above the head of the navigable part of the river. The entrance to the harbor has been improved by the building of piers and dredging. The west pier has a length of 3,622 feet, in addition to a shore return of 137 feet; the east pier has a length of 2,896 feet, in addition to the abandoned shore connection, 402 feet in length.

Channel.—Dredging in the fall of 1894 made a 15-foot depth in the channel at extreme low water for a width of about 112 feet at the inner end, narrowing to about 90 feet at the outer end, midway between the piers. After the spring freshets of 1895 it was found that the new channel was considerably impaired.

LIGHTS.

Genesee Light.—On the west pier, 30 feet from the outer end, a fixed red light, visible 10⅞ (12½) miles, is shown, 31½ feet above the lake level. The tower, square, pyramidal, is painted brown below and white above.

Charlotte Harbor Light.—At the shore end of the west pier, 1,923 feet from the outer end, 3 lights (fixed red, fixed white, and fixed red, arranged vertically with the white light in the middle) are shown 60 feet above the lake level, from a square, white, pyramidal, skeleton structure.

Fog Signal.—The fog-signal house, brown, is on the old lighthouse crib, on the west side of the west pier, about 1,000 feet from its outer end. The fog signal, a 6-inch steam whistle, gives a blast of 3 seconds followed by a silent interval of 57 seconds. If the whistle is disabled a bell is struck by machinery every 30 seconds.

Directions.—When in not less than 6 fathoms, or about a mile from shore, bring Genesee and Charlotte Harbor lights in line SW. by S. (S. 33° 45′ W.) and stand in.

ROUTES.

A position 2⅔ (3) miles NE. by N. (N. 33° 45′ W.) from Genesee light is the point of departure for all ports east and NE.—

To Big Sodus Bay, an east course for 26 (30) miles, should take a vessel off Big Sodus Bay with the range lights in line.

To Fair Haven.—From the point of departure E. ½ N. (N. 84° 22′ E.) for 37¾ (43½) miles, should take a vessel off Fair Haven with the range lights in line.

To Oswego.—From the point of departure ENE. ¾ E. (N. 75° 56′ E.) for 46⅞ (54) miles, should take a vessel off Oswego.

To Sacketts Harbor.—From the point of departure NE. by E. ¼ E. (N. 59° 03′ E.) for 60¾ (70) miles, should take a vessel 3½ (4) miles west of Stony Point lighthouse; whence NE. by E. (N. 56° 15′ E.) for 12⅛ (14) miles, should take a vessel ½ mile north of Sacketts Harbor lighthouse.

To Cape Vincent.—From the point of departure NE. ¾ E. (N. 53° 26′ E.) for 60¼ (69½) miles, should take a vessel 2 (2¼) miles N. by W. ⅝ W. (N. 18° 16′ W.) of Galloo Island light; thence N. by E. ½ E. (N. 16° 52′ E.) for 11½ (13¼) miles, should take a vessel ¾ mile west of Tibbetts Point lighthouse; from here to the anchorage off Cape Vincent keep about ⅓ mile off shore.

To Kingston.—NE. ⅛ E. (N. 46° 24′ E.) for 60¾ (70) miles, should take a vessel 5⅛ (5⅞) miles ESE. (S. 67° 30′ E.) of False Duck lighthouse; at this point change course to N. by E. ⅝ E. (N. 18° 16′ E.) for 17¾ (20½) miles, when Snake Island light should be abeam; this course passes within a mile of Nine-Mile (Gage) Point, and between the two unmarked shoals north of it. Do not pass east of a line joining Nine-Mile (Gage) Point and Pigeon Island lights until close up to Snake Island light. Continue N. by E. ⅝ E. (N. 18° 16′ E.) from abeam of Snake Island light for ⅞ (1) mile, or until Snake Island light bears SSE. ⅝ E. (S. 29° 31′ E.) and Center Brother Island light bears W. ¼ N. (N. 87° 11′ W.), when change course to ENE. ¼ E. (N. 70° 18′ E.) and run along the shore, keeping not more than ¼ mile off to avoid the two 12-foot patches off Kingston, which should be kept to starboard if unmarked. See caution, page 62.

Charlotte to Pultneyville.—The coast from Charlotte trends ESE. 3 (3½) miles to Irondiquot Bay, the entrance of which is entirely closed by shoals. The country around this bay is more elevated, being from 120 to 180 feet high. From the bay the coast trends ENE. 4¾ (5½) miles to Lyons Point. Shoals extend north and NE. from this point ½ mile. Smoky Point is 5¼ (6) miles east of Lyons Point, the coast between being shoal ¼ mile off shore. From Smoky Point the coast continues easterly 5⅔ (6½) miles to Pultneyville. At 2¼ (2½) miles west of Pultneyville a shoal spit extends ½ mile from shore with 14 feet at its outer end.

Pultneyville.—Pultneyville Harbor, at the mouth of Salmon Creek, has been improved by the building of piers and by dredging, but it is only available for small craft.

Pultneyville to Big Sodus Bay.—Fairbanks Point, 1¾ (2) miles east of Pultneyville, is a slight projection on the coast and has shoal water extending off it for ⅓ mile. The entrance to Big Sodus Bay is 8¼ (9½) miles from Fairbanks Point, the coast between trending a little south of east. Shoals extend off ¾ mile from the shore bordering the bay.

Big Sodus Bay.—The entrance to Big Sodus Bay is between Sodus and Charles points and has been improved by dredging and by building piers. The bay, 5 (5¾) miles long, 2 (2½) to 3 (3½) miles wide, is deep and landlocked and midway between Oswego and the Genesee River.

Channel.—The dredged cut between the piers runs diagonally from the outer end of the west pier to 50 feet off the inner end of the east pier. In February, 1895, there were about 12 feet depth and 100 feet width in the narrowest part of this cut.

LIGHTS.

Big Sodus Bay.—On Sodus Point a fixed white light varied by a flash by a flash every 2 minutes is shown 70 feet above the lake level from a square tower with a dwelling attached. The light is visible 13⅞ (16) miles.

Big Sodus (outer.)—On a crib, 30 feet from the outer end of the west pier, a fixed white light, 32½ feet above the lake level, is shown from a square, pyramidal tower, brown below and white above. The light is visible 10⅞ (12½) miles.

Big Sodus (inner).—On the west pier 1,530 feet S. ⅜ W. (S. 3° 45′ W.) from the outer light, a fixed red light, 24 feet above the lake level, is shown from a white, square, pyramidal tower, surmounted by a lantern with copper roof. The light is visible 7⅓ (8½) miles.

Directions.—The outer light may be approached on any bearing from ESE. to SW., but not inshore of these bearings. When about 2 (2½) miles off shore bring the lights in line S. ⅜ W. (S. 4° 13′ W.) and stand in. The mid-channel course from the inner light in, past Sand Point, is SE. ⅛ S. (S. 43° 35′ E.).

ROUTES.

From a position 1¾ (2) miles north of Big Sodus outer light—

To Oswego.—NE. by E. ½ E. (N. 61° 52′ E.) for 22½ (26) miles should take a vessel off Oswego.

To Sacketts Harbor.—NE. ½ N. (N. 39° 22′ E.) for 40¾ (47) miles should take a vessel 3½ (4) miles west of Stony Point light, whence NE. by E. (N. 56° 15′ E.) for 12⅛ (14) miles, should take a vessel north of Sacketts Harbor light.

To Cape Vincent.—NNE. ½ E. (N. 28° 07′ E.) for 53 (61) miles should take a vessel 1½ (1¾) miles west of Tibbetts Point light, whence stand up for anchorage off Cape Vincent, keeping about ⅓ mile off shore.

To Kingston.—N. by E. ¾ E. (N. 19° 41′ E.) for 53 (61) miles should take a vessel ¾ mile west of Nine-Mile (Gage) Point, thence N. by E. ⅜ E.

(N. 15° 28′ E.) 3½ (3⅞) miles should take a vessel NNW. ⅝ W. (N. 29° 31′ W.) of Snake Island light; here change course to ENE. ¼ E. (N. 70° 18′ E.) and run along the shore, keeping not more than ¼ mile off to avoid the two 12-foot patches off Kingston. These patches should be kept to starboard if unmarked. The course, before reaching Snake Island, passes between two unmarked shoals north of Nine-Mile (Gage) Point. Do not pass east of a line joining Nine Mile and Pigeon Island lights until close up to Snake Island. See caution, page 62.

Big Sodus Bay to Little Sodus Bay.—Between these bays the coast is fringed with shoals which extend off in places ¾ mile. These bays are 12⅛ (14) miles apart, and at Big Sodus Bay the coast changes direction to the northeastward. In this stretch several creeks empty into the lake. East and Port bays, their entrances closed by shoals, also lie along this stretch.

Little Sodus Bay, on which is Fair Haven, is 2 (2¼) miles long north and south and ⅜ mile wide. It is deep and landlocked and midway between Oswego and Great Sodus.

The entrance to the bay has been improved by dredging and by building piers, the object being to contract the entrance to the bay to a width of 250 feet, and to maintain a channel 200 feet wide and 16 feet deep at extreme low water.

Channel.—The west and east piers lack 200 and 465 feet, respectively, of reaching the 15-foot curve, and the channel between the piers carries but 14 feet at extreme low water for a least width of 40 feet, extending from deep water in the bay to deep water in the lake, 300 feet outside of the west pier.

LIGHTS.

Fair Haven (outer.)—Twenty-eight feet from the outer end of the west pier at the entrance to the bay, a fixed white light, 31½ feet above the lake level, is shown from a square, pyramidal tower, brown below and white above. The light is visible 10⅞ (12½) miles.

Fog Signal.—A bell struck by machinery; a double blow every 20 seconds.

Fair Haven (inner).—Near the inner end of the west pier a fixed white light, 20½ feet above the lake level, is shown from a white mast.

Directions.—Fair Haven outer light may be approached bearing between SSW. ½ W. (S. 28° 07′ W.) and E. by S. (S. 78° 45′ E.), but nothing inshore of these bearings. When about 2 (2¼) miles off the light bring the range lights in line S. ⅝ E. (S. 7° 01′ E.) and stand in between the piers. The lights in line from within the bay serve also as a range for making the channel between the piers when leaving.

ROUTES.

From a position 1⅜ (2) miles north of Fair Haven outer light—

To Oswego.—Steer NE. ⅛ E. (N. 46° 24′ E.) for 7 (8) miles, when change course to ENE. ⅛ E. (N. 68° 54′ E.) for 3½ (4) miles. This should take a vessel off Oswego and clear of the rocky shoal extending nearly a mile off shore 2⅜ (3) miles west of Oswego.

To Sacketts Harbor.—NNE. ½ E. (N. 28° 07′ E.) for 30⅞ (35½) miles, should take a vessel 3½ (4) miles west of Stony Point lighthouse, whence NE. by E. (N. 56° 15′ E.) for 12⅛ (14) miles should take a vessel ½ mile north of Sacketts Harbor lighthouse.

To Cape Vincent.—N. by E. ⅜ E. (N. 15° 28′ E.) for 31¾ (36½) miles should take a vessel 2¾ (3¼) miles west of Galloo Island light; here change course to N. by E. ⅜ E. (N. 15° 28′ E.) for 13 (15) miles, which should take a vessel 1½ (1¾) miles west of Tibbetts Point lighthouse, whence stand up for the anchorage off Cape Vincent, keeping about ⅛ mile off shore.

To Kingston.—N. ⅛ E. (N. 1° 24′ E.) for 32⅛ (37) miles, should take a vessel 5⅛ (5⅞) miles ESE. (S. 66° 30′ E.) of False Duck Island light. At this point change course to N. by E. ⅝ E. (N. 18° 16′ E.) for 17¾ (20½) miles, when Snake Island light should be abeam; this course passes within a mile of Nine-Mile (Gage) Point lighthouse and between the two unmarked shoals north of it. Do not pass east of a line joining Nine-Mile (Gage) Point and Pigeon Island lights until close up to Snake Island light. Continue N. by E. ⅝ E. (N. 18° 16′ E.) from abeam of the light for ⅞ (1) mile, or until Snake Island light bears SSE. ⅝ E. (S. 29° 31′ E.) and Center Brother Island light bears W. ¼ N. (N. 87° 11′ W.), when change course to ENE. ¼ E. (N. 70° 18′ E.) and run along the shore, keeping not more than ¼ mile off to avoid the two 12-foot patches off Kingston. These patches should be kept to starboard if unmarked. See caution, page 62.

Little Sodus Bay to Oswego.—From the bay the coast trends NE. by N. for 5¼ (6) miles to Nine-Mile Point; here it changes its direction and trends NE. by E. the same distance to the breakwater at Oswego.

Shoal.—Three and one-half (4) miles SW. of Oswego Breakwater light a rocky shoal spit extends off shore ¾ mile, with only 6 feet near its outer end. Although not a serious menace to navigation, yet disabled craft have been driven on the shoal.

Currents in the vicinity of the shoal are generally very light and eastward toward the St. Lawrence.

Oswego, at the mouth of the Oswego River, is the principal United States port on Lake Ontario.

Improvements.—An outer harbor is formed by the west breakwater which, 6,033 feet long, incloses 100 acres outside the 9-foot curve of what

was formerly the lake front. It starts from the main shore nearly a mile westward of the mouth of the river and extends eastward on a line generally parallel to the lake front and 1,200 feet from it, to a point opposite the entrance to the inner harbor. The shore arm is 916⅓ feet long, extending from the shore into the lake to the 18-foot depth. There is a break 140 feet wide in the lake arm near the shore arm; this break will be permanent. It has served as a convenient entrance for vessels, and it also improves the sanitary condition of the harbor.

There are also two inner piers, with shore arms, which protect the immediate entrance to Oswego River; the west pier also partially protecting the outer harbor.

The entrance to the outer (west) basin is exposed to the force of NE. gales, and, in strong winds from this direction, it is almost impossible for a sailing vessel to enter.

Depths.—February, 1895, the outer harbor has an available depth of 18 feet at extreme low water, this depth, with sand bottom, being at the entrance. The inner harbor has a 15-foot depth at extreme low water up to the Northwestern Elevator and to the coal trestles slip. The deep water now extends for the full width of the river up to a line 316 feet south from the north side of this elevator.

Lights—Oswego.—Near the inner end of the west pier, 75 feet above the lake level, is a fixed white light, shown from an octagonal, pyramidal, gray tower, with an oil room attached. The light is visible 14⅓ (16½) miles.

Oswego Breakwater.—On a crib inside the east angle of the breakwater and 1,250 feet NW. by N. (N. 33° 45′ W.) from Oswego light is a fixed red light, 39 feet above the lake level and visible 11⅕ (13¼) miles; it is shown from a brown, octagonal, pyramidal tower.

Fog Signal.—At this station the fog signal is a bell, struck by machinery every 12 seconds.

Directions.—From the northeastward Oswego light should not be brought to bear inshore of the bearing SSW. (S. 22° 30′ W.). When a mile off shore bring the two lights in line SE. by S. (S. 33° 45′ E.) and stand in for the entrance to the river, leaving the lights to starboard.

Routes.—From a position ⅞ (1) mile north of Oswego light—

To Sacketts Harbor.—N. by E. ¾ E. (N. 15° 28′ E.) for 22 (25¼) miles should take a vessel 3½ (4) miles west of Stony Point lighthouse; when NE. by E. (N. 56° 15′ E.) for 12⅛ (14) miles should take a vessel ½ mile north of Sacketts Harbor light.

To Cape Vincent.—North for 24⅓ (28) miles should take a vessel 2¾ (3¼) miles west of Galloo Island light; here change course to N. by E. ⅜ E. (N. 15° 28′ E.) for 13 (15) miles, which should take a vessel 1½ (1¾)

miles west of Tibbetts Point light, whence stand up for the anchorage off Cape Vincent, keeping about $\frac{1}{8}$ mile off shore.

To Kingston.—N. $\frac{1}{4}$ W. (N. 2° 48′ W.) for 40 (46) miles should take a vessel $\frac{3}{4}$ mile west of Nine-Mile (Gage) Point, thence N. by E. $\frac{3}{8}$ E. (N. 15° 28′ E.) $3\frac{1}{3}$ ($3\frac{7}{8}$) miles should take a vessel NNW. $\frac{5}{8}$ W. (N. 29° 31′ W.) of Snake Island light, whence change course to ENE. $\frac{1}{4}$ E. (N. 70° 18′ E.) and run along the shore, keeping not more than $\frac{1}{4}$ mile off to avoid the two 12-foot patches off Kingston, which should be kept to starboard if unmarked. The course before reaching Snake Island passes between two unmarked shoals north of Nine Mile (Gage) Point. Do not pass east of a line joining Nine-Mile Point and Pigeon Island lights until close up to Snake Island. See caution, page 62.

EAST SHORE OF LAKE ONTARIO.

Caution.—Compass bearings can not be closely relied upon at the eastern end of Lake Ontario. In the neighborhood of the Main Duck islands it has been frequently observed that there is a great deviation of the compass, sometimes as great as a point at a time. This renders navigating very uncertain in thick or foggy weather. This deviation is due, most probably, to numerous superficial deposits of iron ore. An examination of the magnetic observations that have been made in the Province of Ontario, Canada, shows that there are numerous localities in the region immediately above Lake Ontario where there are considerable local irregularities. The dips at Kingston and Belleville, at the foot of Lake Ontario, and at Prescott, on the St. Lawrence River, are among the most irregular recorded on the Magnetic Survey of Canada, and it is certain that both the compass and the dipping needle will be subject to notable and irregular local influences in the eastern portion of the lake. At Brockville, about 12 miles west of Prescott, and at Cornwall, about 46 miles east of that place, the anomaly disappears.

Coast.—From Oswego the coast trends NE. $5\frac{1}{4}$ (6) miles to the west end of a wide bluff point, the east end of which is Nine-Mile Point. At this point the coast bends to the southeastward for $1\frac{3}{4}$ (2) miles to Pleasant Point, where it again changes direction to the eastward for $3\frac{1}{4}$ ($3\frac{3}{4}$) miles to the mouth of Little Salmon River, where there is a life saving station.

Texas is about a mile up this river. From here the coast continues easterly for a short distance, when it changes direction to almost north, and so continues for $17\frac{1}{3}$ (20) miles to Stony Creek, forming the eastern shore of the lake. There are many creeks and several closed ponds or bays along this stretch, but all are useless for navigation purposes.

Port Ontario on the Salmon River is $3\frac{7}{8}$ ($4\frac{1}{2}$) miles NE. of Texas Life Saving Station. There is another life saving station $8\frac{3}{8}$ (10) miles north

of the Salmon River. South of Stony Creek and ⅝ mile off shore is Drowned Island, surrounded by shoals and connected to the shore by a shoal spit.

Between Stony Creek and Stony Point are two small rocky bays, partially filled with shoals. From Texas to Stony Point the shore is comparatively steep-to, rocky, and without a harbor.

Stony Point is the eastern point of the bay at the NE. end of Lake Ontario, which is partially closed by a chain of islands stretching WNW. from Stony Point to South Bay Point on the Canadian side.

Stony Point Light.—A fixed white light varied by a white flash every 2 minutes is shown 38 feet above the lake level, from a square gray tower attached to a dwelling. The light is visible 11½ (13¼) miles.

Stony Island lies nearly 2 (2¼) miles from the mainland, north of Stony Point, the channel between being deep and free of dangers. The island is narrow and extends NE. and SW. 3½ (4) miles with a greatest width of one (1¼) mile at its southern end, tapering to a narrow point at its NE. end. The island is almost divided by a lake extending NE. and SW. On the NW. side of Stony Island lies Dutch John Bay; it is ¾ mile wide at its entrance and ⅓ mile deep, has ample water and affords a snug anchorage and protection from south and east winds. The NW. point of the island is shoal ¼ mile off, the southern face for ½ mile, and the SW. point is prolonged SW. for 2 (2¼) miles by Calf Island and Calf Island spit. The latter, narrow and rocky, extends one (1¼) mile from Calf Island, and has 10 feet near its extremity. The rest of the island is steep-to.

Buoy.—A black nun buoy is moored in 15 feet near the end of Calf Island spit.

Little Galloo Island lies about midway between Stony Island and Galloo Island, 2¼ (2½) miles to the westward. The island is ⅓ mile long and half as broad. Shoals extend nearly ¼ mile NE. from the NE. end of the island, and ½ mile SW., south, and SE., from the SW. end. A small islet lies on the NE. shoal.

Galloo Island is 4⅔ (5¼) miles long and has an average breadth of about a mile. Shoals extend nearly ½ mile from the NE. end and ¾ mile from the SW. end of the island, the main shore of the island being steep-to. Behind a rocky reef on the NE. end of the island is Gills Harbor, suitable only for very small craft. The NW. end has a slight indentation known as North Pond; ½ mile off this part of the island is a 14-foot shoal, narrow and extending ⅝ mile NE. and SW. The channel between Galloo and Stony islands, with the exception of the shoals surrounding Little Galloo, is deep, but should not be attempted.

Galloo Island Light.—On the SW. end of Galloo Island is a fixed white light shown 58¼ feet above the lake level, from a conical gray

tower connected by covered way with dwelling. The light is visible 13 (15) miles.

Galloo Island Shoal lies 1⅓ (1½) miles NW. from the SW. end of Galloo Island. It is 620 yards long and 300 yards wide, with least water (6 feet) near its NE. end. There is deep water between Galloo Island and shoal. This shoal is much dreaded and has been the cause of several wrecks.

Buoy.—A black nun buoy is moored in 18 feet on the west side, and 100 yards from the southern end of this rocky shoal. Pass to the westward of this buoy.

Henderson Bay.—From Stony Point the coast trends north and NE., forming a low peninsula and protecting Henderson Bay on the SW. The bay is 4¾ (5½) miles wide between Snow Shoe Point and Horse Island, and about 2 (2¼) miles long, with ample water and good bottom for anchorage. The eastern end of the bay has shoals extending a mile off shore. The SW. end is steep-to, and here are Whites Bay and Henderson Harbor, on the latter is Port Henderson. Shoals and islands lie across the mouth of the bay, leaving two narrow channels; the eastern one is between Gull and Snake Islands shoals on the one side and Horse Island on the other. Shoals extend westward ¾ mile from Horse Island. This passage is deep and should be used in entering the bay. The shoal extending NE. from Six Town Point is known as Lime Barrel Shoal and has only 3½ feet on its shallowest part. It is not safe to enter Henderson Bay except by daylight, because of the shoals, low land, and the absence of lights and other marks.

Note.—The island designated on the chart as Gull is Snake, and Snake is Gull.

Black River Bay is over a mile wide at its entrance and extends NE. 4¾ (5½) miles, the shores of the bay contracting slightly as its head is approached. This bay has deep water and the shores are steep-to, except at its head (where the Black River empties), which is filled with flats; here the bay opens out to the SE., forming Muscalonge Bay, which is very shoal. The town of Dexter is a mile within the mouth of the Black River.

Sacketts Harbor is on the southern shore of the bay, just within Horse Island. This harbor is protected by a natural spur of loose rock and gravel, about 800 feet in length, extending easterly from the shore, forming a small sheltered bay. There is a depth within the harbor of 12 feet at extreme low water.

Directions.—Entering the harbor, Shiphouse Point may be rounded close-to, and the eastern wharves of the town steered for. A narrow sandbar extends two-thirds of the way from Shiphouse Point to the southern wharves.

Sacketts Harbor Light.—On Horse Island a fixed white light, 47 feet above the lake level, is shown from a square, red tower attached to a dwelling. The light is visible 12⅛ (14) miles.

ROUTES.

From a position ½ mile north of Sacketts Harbor light—

To Cape Vincent.—Steer W. ¼ S. (S. 87° 11′ W.) 6 (7) miles, when the extreme SW. point of Point Peninsula should bear N. by E. ⅜ E. (N. 15° 28′ E.); change course to NW. ⅜ W. (N. 49° 13′ W.) for 7⅓ (8½) miles, when the extreme SW. point of Grenadier Island should bear ENE. ⅞ E. (N. 77° 20′ E.). (In rounding Grenadier Island do not shoal to less than 10 fathoms to avoid the spit extending SW. from the island.) At this point change course to N. by E. ½ E. (N. 16° 52′ E.) for 4¾ (5½) miles, when Tibbetts Point light should bear east distant ¾ mile; from here to the anchorage off Cape Vincent keep about ⅓ mile off shore. The anchorage off Cape Vincent is not good in heavy westerly weather, but good anchorage may be had off the foot of Carlton Island.

To Kingston.—When S. by W. ⅜ W. (S. 15° 28′ W.) of the SW. point of Point Peninsula, change course to NW. by W. ⅝ W. (N. 63° 16′ W.) for 14⅓ (16½) miles, when Pigeon Island light should bear NE. by E. ½ E. (N. 61° 52′ E.), distant 1½ (1¾) miles; here change course to N. ¼ E. N. 2° 48′ E.) for 6 (7) miles, when a vessel should be one mile west of Nine-Mile (Gage) Point light; thence N. by E. ⅜ E. (N. 15° 28′ E.) 3⅓ (3⅞) miles should take a vessel NNW. ⅝ W. (N. 29° 31′ W.) of Snake Island light, whence change course to ENE. ¼ E. (N. 70° 18′ E.) and run along the shore, keeping not more than ¼ mile off, to avoid the two 12-foot patches off Kingston. These patches should be kept to starboard if unmarked. The course, before reaching Snake Island, passes between two unmarked shoals north of Nine-Mile (Gage) Point. Do not pass east of a line joining Nine-Mile Point and Pigeon Island lights until close up to Snake Island. See caution, page 62.

Vessels of 15 feet draft may pass between Simcoe and Snake islands. The channel is buoyed on the east side of Snake Island, and by keeping the Snake Island buoy close aboard, or leaving two-thirds of the passage to the eastward, you can, by steering to the northward slowly as you pass Snake Island, keep good water, but you can not, with a vessel drawing over 11 feet, steer straight for Kingston when abreast of Snake Island.

Caution.—After clearing Point Peninsula do not shoal to less than 10 fathoms until west of Nine-Mile (Gage) Point, to avoid Charity Shoal and the shoals extending from Pigeon Island.

Coast.—From Bull Rock point, the north entrance point to Black River, to Pillar Point, 1½ (1¾) miles NW., the shore recedes, forming a small bay, almost filled with shoals, extending out from both points for nearly ½ mile. From Pillar Point the coast trends to the NE. and east to the head of Guffin Bay.

Guffin Bay.—The shores of this bay are steep-to, except at its head, where Guffin Creek empties. One mile up this creek is the town of Dex-

ter. Vesuvius Point and Cherry Island form the north shore of this bay and separate it from Chaumont Bay.

Chaumont Bay to Cherry Island has the same entrance as Guffin Bay, the SE. face of Point Peninsula forming the northern entrance shore. The bay has from 3½ to 4 fathoms, mud bottom in the center and western half, but the eastern half is filled with shoals, which extend out as a spit almost to the center of the bay. Catfish River empties into this bight, and on it is the town of Chaumont.

Three-Mile Bay, a small indentation on the north shore, has 3½ fathoms at its entrance, but its head is shoal. A town of the same name is on this bay.

Coast.—Point Peninsula is 5¼ (6) miles long NE. and SW. Its SE. face is steep-to, except around the SW. point, which is shoal ½ mile off. Several wrecks have occurred on this point, and it should be given a wide berth. Between the SW. point and Tibbetts Point, 9½ (11) miles NNW., the coast is very irregular and broken. About midway between the points are Fox and Grenadier Islands, connected with each other and with the shore by shoals, which line all this part of the coast. A shoal spit extends one mile west from the west end of Grenadier Island, and vessels rounding this spit should not shoal to less than 10 fathoms.

Baird Point is the southern point of a small shoal inlet known as Mud Bay, into which Mud Creek empties.

Stony Point is the north point of Mud Bay. Between Stony Point and Grenadier Island vessels with local knowledge will find good anchorage and protection from all but westerly winds.

A rocky spit extends a mile west from Stony Point, and north of this point is Wilson Bay.

Wilson Point, the north point of Wilson Bay, has a shoal spit extending ⅓ mile from it, and ¼ mile from the end of the spit is a detached 14-foot shoal.

Fuller Bay lies between Wilson and Tibbetts points, the southeastern entrance point to the St. Lawrence River.

Tibbetts Point Light.—On the point a fixed white light, 68¾ feet above the lake level, is shown from a round, gray tower with oil room at the base, the keeper's dwelling being to the northward. The light is visible 12⅛ (14) miles, and marks the turning point for the south and best channel into the St. Lawrence River.

From Tibbetts Point the coast trends NE. 2¼ (2½) miles, to the town of Cape Vincent, and is steep-to except around and near the point.

Cape Vincent is on the south shore of the St. Lawrence River near the entrance to the South Channel, and is the first United States port after entering the river.

Cape Vincent to Kingston.—From $\frac{1}{3}$ mile off Cape Vincent SW. $\frac{3}{4}$ W. (S. 53° 26′ W.) for $5\frac{3}{8}$ ($6\frac{1}{2}$) miles should take a vessel one ($1\frac{1}{4}$) mile S. $\frac{7}{8}$ W. (S. 9° 50′ W.) of Bear Point; change course to W. $\frac{3}{4}$ N. (N. 81° 33′ W.) for $4\frac{1}{4}$ ($4\frac{7}{8}$) miles when Pigeon Island light should be abeam, whence N. by W. $\frac{1}{2}$ W. (N. 16° 52′ W.) 4 ($4\frac{1}{2}$) miles should take a vessel $\frac{3}{4}$ mile west of Nine-Mile (Gage) Point light, thence N. by E. $\frac{3}{8}$ E. (N. 15° 28′ E.) $3\frac{1}{3}$ ($3\frac{7}{8}$) miles should take a vessel NNW. $\frac{5}{8}$ W. (N. 29° 31′ W.) from Snake Island light, whence change course to ENE. $\frac{1}{4}$ E. (N. 70° 18′ E.) and run along the shore, keeping not more than $\frac{1}{4}$ mile off to avoid the two 12-foot patches off Kingston. These patches should be kept to starboard if unmarked. The course, before reaching Snake Island, passes between two unmarked shoals north of Nine-Mile (Gage) Point. Do not pass east of a line joining Nine-Mile Point and Pigeon Island lights, until close up to Snake Island. See caution, page 62.

CANADIAN SHORE.

Hinckley Point, of Wolfe or Long Island, is opposite Cape Vincent, and from here the coast of the island trends SW. $4\frac{6}{10}$ ($5\frac{1}{4}$) miles to Bear Point, $\frac{1}{3}$ mile off which is a detached 14-foot shoal. The shore between the points is straight, with one shallow indentation, and is steep-to.

Bear Point is a narrow peninsula $\frac{3}{4}$ mile long and is almost connected to the 14-foot detached shoal by a spit, leaving a very narrow channel between, but this channel should not be attempted or the point rounded inside of $\frac{3}{8}$ mile. All the SW. end of Wolfe Island should be given a wide berth as it is a dangerous shore.

Shoal.—A small patch with less than 15 feet on it is reported as lying about $1\frac{3}{10}$ ($1\frac{1}{2}$) miles south of Bear Point. Locally known as "New Found Shoal" (probably "Allen Otty Shoal").

Long Point is a similar but longer peninsula projecting from Wolfe Island $1\frac{1}{3}$ ($1\frac{1}{2}$) miles and is further extended to the SW. for one ($1\frac{1}{8}$) mile by a narrow spit with 16 feet at its SW. extremity and only 5 feet at $\frac{1}{2}$ mile from the point. There have been many wrecks on this point.

Sand Bay, $1\frac{3}{4}$ (2) miles wide between Bear and Long points, is open to the SW., but affords shelter from northerly and easterly winds. A narrow spit, 17 feet at its outer end, projects nearly $\frac{1}{2}$ mile from near the center of the head of the bay, otherwise the shores of the bay may be approached to $\frac{1}{4}$ mile.

Allen Otty or Keill Shoal lies $1\frac{3}{4}$ (2) miles SSW. from Bear Point and $2\frac{1}{2}$ ($2\frac{3}{4}$) miles NE. $\frac{1}{4}$ E. of Charity Shoal. It is a narrow shoal, 700 yards long, with from 15 to 18 feet over it; is unmarked and lies 400 yards north of the range between Charity Shoal buoy and Tibbetts Point lighthouse. It should be avoided in rough weather even by light draft vessels.

Charity Shoal lies $3\frac{7}{10}$ ($4\frac{1}{4}$) miles SW. by S. from Bear Point and $4\frac{3}{4}$ ($5\frac{1}{2}$) miles west from Grenadier Island. This rocky shoal is $\frac{3}{4}$ mile long NE. and SW. and 350 yards wide. It has a least depth of 5 feet.

Buoy.—A red and black horizontal-striped can buoy is moored in 18 feet, 300 yards from the southern end of Charity Shoal. It is $6\frac{1}{2}$ ($7\frac{1}{2}$) miles SW. by W. from Tibbetts Point lighthouse.

Shoal.—A dangerous shoal is reported as lying about $1\frac{1}{3}$ ($1\frac{1}{2}$) miles SE. of Charity Shoal, and is locally known as "East Charity Shoal."

Pigeon Island, $2\frac{6}{10}$ (3) miles NW. by W. from Charity Shoal, is $3\frac{1}{2}$ (4) miles SW. by W. from the end of Long Point. The island is very small and lies in the center of a shoal which extends from it $\frac{3}{4}$ mile NE. and SW., the latter portion of the shoal being $\frac{1}{3}$ mile wide. The lighthouse should be given a berth of at *least* one mile in rounding the island.

Pigeon Island Light.—The lighthouse, painted white, is on the center of the island; from it is shown a white light, revolving every 70 seconds, 67 feet above lake level. It is visible 12 ($13\frac{3}{4}$) miles.

Fog Signal.—A weak hand horn answers signals from vessels.

Reeds Bay, between Long and Bells points, is 2 ($2\frac{1}{4}$) miles wide. The head of the bay is filled with a rocky flat, and, although it offers protection from NE. winds, would hardly serve as a good anchorage on account of its rocky bottom.

Coast.—Bells Point, a very narrow peninsula, has a reef just outside it, and the whole point is surrounded by shoals which extend off shore $\frac{3}{4}$ mile. Between Bells Point and another narrow peninsula point $1\frac{1}{2}$ ($1\frac{3}{4}$) miles to the northward, the coast line bends to the eastward, and forms a small bight filled with reefs and shoals.

Horseshoe Island, $\frac{3}{4}$ mile long and $\frac{1}{4}$ mile broad, lies $\frac{1}{4}$ mile off the northern peninsula point and is connected to it by shoals which surround the island and extend SW. $\frac{1}{2}$ mile.

Bateau Channel, between Horseshoe and the Wolfe Islands on the south and Simcoe Island on the north, is narrow and useless for any but small craft.

Simcoe Island is $3\frac{1}{4}$ ($3\frac{3}{4}$) miles long NE. and SW. and one ($1\frac{1}{4}$) mile wide at its widest part. Its SE. face is steep-to, but elsewhere shoals extend out for some distance, and its NW. point is almost connected to the shoals extending from Snake Island, but the channel between the shoals is buoyed, barrel buoys on the Snake Island side. Shoals extend from its NE. end to Garden Island and Ferguson Point of Wolfe Island and fill up all the intervening space between this line and Wolfe Island. Its SW. end has shoals extending from it $\frac{1}{4}$ mile, and on this end is a lighthouse.

Nine-Mile (Gage) Point Light.—The lighthouse is at the SW. extreme of the island and is a circular tower painted white. From it, 45 feet above the lake level, is shown a fixed white light, visible 12 ($13\frac{3}{4}$) miles.

Fog Signal.—A steam fog horn gives blasts of 8 seconds with silent intervals of 22 seconds.

Clearing Mark.—This light and Pigeon Island light in line, bearing S. ¼ E. (S. 2° 49′ E.), passes close west of a small 15-foot shoal (unmarked) lying one (1¼) mile SW. of Snake Island light and well clear to the eastward of the large shoal, least water 4 feet (unmarked) lying in a parallel direction to Simcoe Island and nearly 1¾ (2) miles from it.

Snake Island is a small island lying near the NW. extreme of a circular shoal with 4 feet on its center. This shoal and the shoal extending from Simcoe Island half close this entrance to the St. Lawrence River. Vessels drawing over 15 feet should not attempt to pass between Snake and Simcoe islands, but should keep west and north of Snake Island.

Snake Island Light.—The lighthouse is square, with dwelling attached, and is built on a crib on Snake Island shoal. From it, 35 feet above the river level, is shown a fixed red light, visible 6 (7) miles.

Wolfe or Long Island.—All the north shore of this island is bordered by shoals. Garden Island lies on the outer edge of these shoals just west of Ferguson Point. Browns or Knapps Point, a rocky peninsula 2 2/10 (2½) miles NE. of Ferguson Point, has a small bay south of it, but it is shoal and only suitable for very small craft.

Browns or Knapps Point Light.—The lighthouse on the north of this point is square and painted white. From it, 28 feet above the river level, is shown a fixed white light, visible 10 (11½) miles.

Shoal.—WSW. ¾ W. one statute mile from Browns Point lighthouse, is an 11-foot detached shoal spot lying almost in mid-channel. It is usually marked by a beacon buoy, and vessels bound up or down the St. Lawrence River should keep the mainland aboard, which is here steep-to.

For Kingston, see page 93.

CHAPTER VIII.

CANADIAN COAST OF LAKE ONTARIO.

FROM NIAGARA RIVER WEST WITH THE WESTERN AND NORTHERN SHORES.

NOTE.—The Canadian shore of Lake Ontario is described from Hydrographic Office Chart 1477. The routes given are taken from United States Lake Survey Chart No. 61 for the body of the lake, and United States Lake Survey Chart No. 60 for the bay at the St. Lawrence River.

Table of Directions and Distances between Light Stations on the North and South Shores of the Lake. The outer pier lights are taken.

Stations.	Directions.	Nautical miles.	Statute miles.
Gibraltar (Lighthouse) Point to Port Dalhousie	S. 12° E.	24¾	28½
Port Niagara	S. 34° E.	25$\frac{4}{10}$	29¼
Olcott	S. 60¾° E.	33$\frac{4}{10}$	38½
Oak Orchard	S. 74¾° E.	54	62¼
Great Sodus Bay	S. 79¼° E.	107¼	123½
Fair Haven	S. 82½° E.	117$\frac{8}{10}$	135⅔
Oswego	S. 86° E.	125¼	144¼
Whitby Harbor to Port Dalhousie	S. 21½° W.	40¼	46⅓
Fort Niagara	S. 10° W.	34¾	40
Olcott	S. 16° E.	30⅔	35⅓
Oak Orchard	S. 49¼° E.	42$\frac{1}{10}$	48½
Great Sodus Bay	S. 68¾° E.	91$\frac{8}{10}$	105
Fair Haven	S. 73¼° E.	100¾	116
Oswego	S. 78¼° E.	106$\frac{8}{10}$	123
Coburg to Port Dalhousie	S. 48° W.	64$\frac{7}{10}$	74½
Fort Niagara	S. 44° W.	56¼	64¾
Olcott	S. 34½° W.	43$\frac{8}{10}$	49¾
Oak Orchard	S. 2¼° W.	33⅔	38¾
Charlotte Harbor	S. 30¾° E.	46$\frac{8}{10}$	54
Great Sodus Bay	S. 52¼° E.	64$\frac{8}{10}$	74¾
Fair Haven	S. 60½° E.	72$\frac{1}{10}$	83
Oswego	S. 68½° E.	76$\frac{4}{10}$	88
Presqu' Ile to Port Dalhousie	S. 56½° W.	83$\frac{8}{10}$	95¾
Fort Niagara	S. 54½° W.	73$\frac{8}{10}$	85
Olcott	S. 50° W.	59¼	68¼
Oak Orchard	S. 32° W.	42½	49
Charlotte Harbor	S. 3½° E.	43	49½
Great Sodus Bay	S. 35½° E.	51$\frac{8}{10}$	59¾
Fair Haven	S. 47½° E.	56½	65
Oswego	S. 58½° E.	58$\frac{8}{10}$	67½

Niagara River.—For a description of this river and the offlying shoals, see page 64.

Niagara River to Welland Canal.—The coast trends west for 2¼ (2½) miles, then changes its direction to SW. by W. ½ W. for 6¾ (7¾) miles to the entrance of the Welland Canal. Shoals line this coast and extend offshore in places ¾ mile.

Port Dalhousie.—See page 63.

Shoal.—There is an 18-foot detached shoal ¼ mile NNE. ¾ E. of the outer pier light.

Port Dalhousie to Burlington Bay.—The coast trends W. by N. 22 (25¼) miles to the south end of the narrow sand spit separating Burlington Bay from Lake Ontario. Except for about 5 (5¾) miles west of Port Dalhousie, it is everywhere steep-to and has no offlying dangers. There are several creeks in this stretch which afford good shelter and boat landings.

Burlington Bay is a large sheet of deep water, free from danger, the entrance to which is by a canal cut through the sand spit which separates it from Lake Ontario. There is a shoal approaching the docks, but it is well buoyed and the navigation is safe.

Burlington Canal is between two breakwater piers built and maintained by the Public Works Department of Canada. The canal is 2,300 feet long and varies in width from 170 feet at the outer end to 106 feet near the inner end, and carries 14 feet of water. The south pier extends 420 feet farther into the lake than the north pier. The canal is crossed near the middle by a swing bridge of the Grand Trunk Railway.

Danger Signal.—At night this bridge is marked in the center by a red danger signal.

RANGE LIGHTS.

Front Light.—The lighthouse is near the outer end of south pier; it is 30 feet high, circular, and painted white. From it, at 30 feet above the lake level, is shown a fixed white light, visible 4 (4½) miles.

Main (rear) Light.—The lighthouse is a gray, circular building 79 feet high, built on the beach near the middle of the south pier, and 1,570 feet SW. by W. ⅛ W. (S. 57° 39′ W.) from the front light. From the lighthouse, at 75 feet above the lake level, is shown a fixed white light, visible 15 (17¼) miles.

Fog Signal.—A hand horn answers signals from vessels.

Storm Signals.—There is a signal mast on Burlington Beach, in latitude 43° 16′ N. and longitude 79° 54′ W., from which the Canadian storm signals are shown.

Storms.—October and November are the months in which severe storms are most frequent. The wind, invariably commencing at SE., works around through south to west and NW., the time of the hardest blow being usually when the barometer begins to rise as the wind gets round to west.

Hamilton is the manufacturing center of the Dominion of Canada. Its population is about 50,000, and it has direct railway communication with all parts of the Province and the United States. There are ample wharves. There are no port charges or dues, and no pilotage. The United States is represented by a consul.

Directions.—Vessels making the canal from the lake should bring the two lights in range SW. by W. $\frac{1}{8}$ W. (S. 57° 39′ W.) and keep them in one until close to the front light, which should be left to port and passed at a distance of about 100 feet. After having passed through the canal the course is SW. to the wharves of the city.

ROUTES.

Burlington Bay to Charlotte and Oswego.—From off the canal entrance an E. $\frac{7}{8}$ N. (N. 80° 09′ E.) course for 57$\frac{1}{2}$ (66) miles should take a vessel 5$\frac{3}{8}$ (6$\frac{1}{2}$) miles north of Thirty-Mile Point light, which is a new point of departure.

To Charlotte.—From this point of departure an E. $\frac{5}{8}$ S. (S. 82° 58′ E.) course for 35$\frac{6}{10}$ (41) miles should take a vessel 8$\frac{1}{4}$ (9$\frac{1}{2}$) miles N. by W. $\frac{3}{4}$ W. (N. 19° 41′ W.) of Genesee outer light, whence the course is S. by E. $\frac{3}{4}$ E. (S. 19° 41′ E.) to the light.

To Oswego.—From off Thirty-Mile Point an E. $\frac{1}{8}$ N. (N. 88° 36′ E.) course for 86 (99) miles should take a vessel off Oswego Harbor.

Burlington Bay to Toronto.—After clearing the canal, continue the course NE. by E. $\frac{1}{8}$ E. (N. 57° 39′ E.) for 10 (11$\frac{1}{2}$) miles, when change course NE. by N. (N. 33° 45′ E.) for 14$\frac{3}{4}$ (17) miles, when a vessel should be off Gibraltar (Lighthouse) Point light; thence steer for eastern or western entrance to harbor, as desired.

To Coburg.—After clearing the canal a NE. by E. $\frac{5}{8}$ E. (N. 63° 16′ E.) course for 79$\frac{1}{2}$ (91$\frac{1}{2}$) miles should take a vessel south of Coburg lights.

To Kingston.—After clearing the canal steer ENE. $\frac{5}{8}$ E. easterly (N. 75° E.) for 117$\frac{1}{4}$ (135) miles; this should take a vessel 2$\frac{1}{2}$ (2$\frac{9}{10}$) miles south of Peter Point light and 1$\frac{1}{4}$ (1$\frac{4}{10}$) miles south of the rocky spit extending south from the point. Here change course to ENE. $\frac{1}{4}$ E. (N. 70° 18′ E.) for 20$\frac{1}{2}$ (23$\frac{6}{10}$) miles, when False Duck light should bear WNW. (N. 67° 30′ W.) 3$\frac{3}{4}$ (4$\frac{1}{3}$) miles, and a vessel will be clear to the eastward of Harris Shoal. At this point change course (U. S. Lake Survey Chart No. 60) to NNE. $\frac{1}{8}$ E. (N. 23° 54′ E.) for 18 (20$\frac{3}{8}$) miles, when Snake Island light should be abeam; this course passes about a mile off Nine-Mile (Gage) Point light, and between two unmarked shoals north of it. Do not pass east of a line joining this last light and Pigeon Island light until close up to Snake Island light. Continue the NNE. $\frac{1}{8}$ E. (N. 23° 54′ E.) course from abeam of Snake Island light for $\frac{7}{8}$ mile, or until this light bears S. by E. $\frac{1}{4}$ E. (S. 13° 04′ E.) and Center Brother Island light bears W. $\frac{1}{8}$ N.

(N. 88° 35′ W.), when change course to ENE. ¼ E. (N. 70° 18′ E.) and run along the shore, keeping not more than ¼ mile off, to avoid the two 12-foot patches, if unmarked, off Kingston. These patches should be kept to starboard. See caution, page 62.

Vessels of 15 feet draft may use the channel between Simcoe and Snake Island. The channel is buoyed on the east side of Snake Island, and by keeping the Snake Island buoy close aboard, or by leaving two-thirds of the channel to the eastward, you can, by steering to the northward slowly as you pass Snake Island, keep good water, but you can not, with a vessel drawing over 11 feet, steer straight for Kingston when abreast of Snake Island.

THE COAST.

Hamilton to Toronto.—From Burlington the coast trends about NE. by N. 24 (27⅔) miles, and has only a few slight indentations where creeks empty. It is steep-to excepting off Clarkson, midway between Oakville and Port Credit; the chart shows a shoal, position doubtful, nearly a mile off shore.

Oakville is at the mouth of Sixteen-Mile Creek.

Oakville Light.—On a cribwork block near inner end of main pier is the lighthouse level, 31 feet high, white, with a red lantern. The light, fixed white, is 39 feet above the lake, and visible 11 (12½) miles.

Port Credit is at the mouth of the Credit River.

Port Credit Light.—The lighthouse, square and painted white, is on the outer end of the north breakwater pier. The light, fixed white, is 37 feet above the lake level and visible 11 (12¾) miles.

Humber Bay, into which the Humber River empties, is just west of Toronto Harbor, the western part of the city being on the bay.

Toronto, the capital of the Province of Ontario, is between the rivers Humber and Don and has a well-sheltered harbor suitable for light draft vessels. The city is the seat of the provincial Government, with the official residence of the Lieutenant Governor and the Government buildings.

The United States is represented by a consul and a vice and deputy consul.

Observatory.—The Magnetical and Meteorological Observatory in the University grounds stands 108 feet above the lake in latitude 43° 39′ 35.9″ N. and longitude 79° 23′ 39.75″ W.

Toronto Harbor is formed by an island inclosing a harbor of nearly 3½ square miles. There are two entrances, both artificial, to the harbor; the western entrance is directly in front of Queens Wharf and separates the island from the main; the eastern entrance, now being constructed, is at the SE. end of the harbor. At present these entrances will not admit of vessels of heavy draft.

Gibraltar (Lighthouse) Point Light.—On the SW. side of the point is a white hexagonal lighthouse with keeper's dwelling near. From this

lighthouse, 66 feet above the lake level, is shown a white light, revolving every 45 seconds. The light is visible 18 (20¾) miles.

Fog Signal.—The fog-signal building of wood, white with brown roof, is 1,150 feet SSW. ½ W. from the lighthouse. The fog signal is a steam horn which sounds blasts of 7 seconds with intervals of 90 seconds.

Queens Wharf Light.—On the west end of the wharf from a white hexagonal building at 23 feet above the lake level is shown a fixed white light visible 9 (10½) miles.

Fog Signal.—A fog bell, attached to the tower, is rung by hand.

Queens Wharf Rear Light.—On extension shoreward of wharf, 200 feet N. 23° 07′ E. from outer light, is a red octagonal lighthouse from which is shown, 37 feet above the lake level, a fixed red light visible 8 (9¼) miles. The two lights in line lead clear of the point of bar running south of and parallel to the wharf.

These lights are maintained by the Toronto Harbor Commissioners.

East Pier Light.—A temporary light established by the Government of Canada on the East Pier at the East Gap or Eastern entrance to Toronto Harbor has been put in operation.

The light is fixed red and 16 feet above the lake level. It should be visible 6 ($6\frac{9}{10}$) miles from all points of approach.

The light is shown from a column surmounting an hexagonal iron shed. The building is 11 feet high and is gray in color. It stands on the pier 100 feet from its outer end, but will be moved nearer the end of the pier and raised as soon as the construction work is finished. Another light to range with it will also be established later.

The light is intended to guide vessels approaching Toronto to the entrance through the East Gap. Mariners will have to allow for the projection of the pier lakeward beyond the light.

Buoys.—A bell and 5 can buoys, all red, mark the bank to the south and SW. of Lighthouse Point. The bell and can buoy to the east are in 5 fathoms. The can buoys to the west are in 8 fathoms, except No. 12, which is in 21 feet. It is not safe for vessels to go inside the buoys, as the bank rises very abruptly. An additional red spar buoy is placed on the NW. point of the island.

Directions.—West Channel.—The red spar buoy on the starboard side of the channel is in 14 feet of water, with the lighthouse bearing N. 7° E., distant 620 feet.

One black buoy is on the north side of the channel at the entrance, with the White lighthouse bearing N. 57° E., distant 750 feet.

There are 11 feet of water in mid-channel. The best water is on the south side of the channel near the breakwater.

Directions.—East Channel.—The buoys in this channel are placed as follows:

Three black spar buoys on the west, or port side coming into the bay. There are 15 feet of water below zero in this channel at present. The channel is 400 feet between the buoys and cribs. Landmarks for entering are the cupola of St. Lawrence hall in line with a point midway between the tower of Metropolitan church and St. Michaels cathedral spire.

A black spar buoy is placed on the boiler shoal to the south of the gap. Vessels should not go to the NW. of it.

Harbor Regulation.—The speed of any vessel entering, leaving, or within the harbor is limited to 4 knots per hour. Vessels offending are subject to a fine of $20.

ROUTES.

Toronto to Charlotte.—From point of departure one mile south of Gibraltar (Lighthouse) Point light an E. ¾ S. (S. 81° 33′ E.) course for 76 (87½) miles should take a vessel 8¼ (9½) miles N. by W. ¾ W. (N. 19° 41′ W.) of Genesee outer light, whence the course is S. by E. ¾ E. (S. 19° 41′ E.) to the light.

Toronto to Oswego.—From point of departure an E. ¼ S. (S. 87° 11′ E.) course for 125 (144) miles will take a vessel off Oswego light.

Toronto to Kingston.—From point of departure an E. ⅜ N. (N. 82° 58′ E.) course for 97¼ (112) miles will take a vessel 2½ ($2\frac{9}{10}$) miles south of Peter Point light and 1¼ ($1\frac{4}{10}$) miles south of the rocky spit extending south from the point. Here change course to ENE. ¼ E. (N. 70° 18′ E.) for 20½ ($23\frac{6}{10}$) miles, when False Duck light should bear WNW. (N 67° 30′ W.) 3¾ (4⅓) miles, and a vessel will be clear to the eastward of Harris Shoal. At this point change course (United States Lake Survey Chart No. 60) to NNE. ⅛ E. (N. 23° 54′ E.) for 18 (20⅞) miles, when Snake Island light should be abeam; this course passes about a mile off Nine-Mile (Gage) Point light and between two unmarked shoals north of it. Do not pass east of a line joining this last light and Pigeon Island light until close up to Snake Island light. Continue the NNE. ⅛ E. (N. 23° 54′ E.) course from abeam of Snake Island light for ⅞ (1) mile, or until this light bears S. by E. ¼ E. (S. 14° 04′ E.) and Center Brother Island light bears W. ⅛ N. (N. 88° 35′ W.), when change course to ENE. ¼ E. (N. 70° 18° E.) and run along the shore, keeping not more than ¼ mile off, to avoid the two 12-foot patches off Kingston. These patches should be kept to starboard if unmarked.

THE COAST.

From Toronto (Gibraltar Light) the coast trends NE. by E. $15\frac{6}{10}$ (18) miles to Port Union on the Rouge River. Just north of Port Union is Frenchman Bay or Pickering Harbor.

Frenchman Bay or Pickering Light.—On the East Pier head is shown, 51 feet above lake level, a fixed green light, visible 10 (11½) miles.

ENE. ⅜ E. 7 (8) miles of this light is Whitby, and 5 (5¾) miles beyond, Oshawa Harbor.

Whitby Light.—On the West Pier, 12 feet above the lake level, is shown a fixed white light, visible 5 (5¾) miles.

Oshawa Light.—A fixed white light is shown from the pier head.

Darlington Light, just east of Raby Head and 7 (8) miles E. by N. from Oshawa light, is shown on pier head in Darlington Harbor. It is fixed white and visible 3½ (4) miles.

Note.—These three last-mentioned lights are *not* under the Marine Department of Canada.

Newcastle (Bond Head) Light, on outer end of East Breakwater pier, is 29 feet above the lake level and visible 10 (11½) miles. The light is fixed white and maintained by the Newcastle Harbor Company.

Peach Stone Reef is 3 (3½) miles east of Bond Head, and 3 (3½) miles beyond this reef, off Port Granby, is another reef close to shore. ENE. of Port Granby 4½ (5¼) miles is Port Britain, and 4 (4½) miles farther in the same direction is Port Hope, at the mouth of Jones Creek. Peter Rock lies close to shore, midway between Port Hope and Coburg.

Port Hope Light, fixed white, is shown 40 feet above lake level, 110 feet from extremity of East Breakwater. It is visible 4 (4½) miles, and is not under Marine Department of Canada.

Port Hope Harbor.—The channel between piers is 200 feet wide at the entrance, with a depth of 17 feet. Eleven feet can be carried to the middle dock.

Storm Signals are shown.

Peter Rock, or Gull Island, Light is fixed white, 45 feet above lake level and visible 10 (11½) miles.

Coburg Lights.—Corporation Light is shown on east pier, 20 feet above lake level. It is a fixed white gas light and visible 8 (9¼) miles.

East Pierhead Light, fixed white, is S. 10° 07′ W. 409 feet outside of Corporation light.

West Pierhead Light, fixed red, is shown on the west pier, at elbow, 190 feet from extremity. It is 26 feet above the lake level and visible 6 (7) miles.

Shoal Bay, 17 (19½) miles east of Coburg, has several shoals in its entrance. Colborne Harbor is between, and just west of Colborne, off Ogden Point, is a reef.

Presqu' Ile Harbor is separated from Shoal Bay by an irregular-shaped peninsula, the south shore of which is lined with reefs. Off the entrance to the bay are several shoals lying almost in mid-channel.

Presqu' Ile Light.—On the east point of the peninsula, from a white octagonal tower, is shown, 67 feet above the lake level, a fixed white light, visible 13 (15) miles.

Salt Point Light is shown from a white, square building on extremity of sand spit north of Presqu' Ile light. The light, fixed white, is 22 feet above the lake level and is visible 4 (4½) miles.

Brighton Harbor has 2 piers, each about 100 yards long. There is about 13 feet depth; vessels keep in center of bay, and in passing out into the lake keep well to the east shore. There are no port charges or pilots.

Brighton Ranges.—No. 3 Light.—At 7,200 feet from end of canal piers and 3,920 feet from Brighton wharf, from a white, square building on octagonal pier is shown, 29 feet above lake level, a fixed white light, visible 3 (3½) miles.

No. 2 Light.—At 5,360 feet S. 67° W. from No. 3 light, and 1,440 feet from Brighton wharf, is a fixed white light 45 feet above the lake level and visible 6 (7) miles. The lighthouse is a white, square building on square pier.

No. 1 Light.—At 1,420 feet S. 65° E. from No. 2 light, and 1,100 feet from Brighton wharf, is a fixed white light 28 feet above the lake level and visible 6 (7) miles. The lighthouse is a white, square building on a square pier.

Brighton—Directions.—No. 3 light tower stands in 15 feet of water in the axis of the Murray Canal and on the north side of the channel, which bears SW. by W. ½ W. (S. 57° 39′ W.); in one with No. 2 light, it leads up from the canal through the center of the channel, and is to be left 100 feet on the starboard hand in passing up. After having passed it, if brought directly ahead, it will guide through the remainder of the dredged channel.

Prince Edward, a large island, is deeply indented on all sides by numerous bays. It is separated from the mainland by Quinte Bay and the channels leading to it. Off the south shore of the island are numerous outlying shoals, and the prominent points have reefs extending from them for some distance.

Wellers Bay is at the western end of Prince Edward Island and directly opposite Presqu' Ile harbor. There are shoals in the approach to this bay.

Wellers Bay Lights.—At the SW. end of Quinte Carrying Place is a white, square lighthouse from which is shown, 26 feet above the lake level, a fixed white light, visible 10 (11½) miles. N. 45° 56′ E. 508 feet from the front light is a fixed red light 37 feet above the lake level and visible 7 (8) miles. The lighthouse is a white, square building.

Directions.—The alignment of the lights leads clear of the extremity of spit off Bald Head, and gives best water (10 feet) over Wellers Bar, 3,300 feet outside the spit. Vessels entering keep the alignment N. 45° 56′ E., until the spit is passed at a distance of 150 feet.

Nicholson Point, the SW. point of Prince Edward, has Nicholson Island lying off it. About a mile south of the west point of Nicholson Island is Scotch Bonnet or Egg Island.

Light.—On this little island is a fixed white light, 51 feet above the lake level and visible 12 (13¾) miles. The white, circular light tower has a dwelling attached.

Reef.—South 1½ (1¾) miles from Egg Island light is the north end of a reef which extends 2 (2¼) miles in a SSW. direction; east of its south end is a small detached reef.

Sandy Bay, between Nicholson and West points, is a deep bay, open to the southward. The town of Wellington is at its head and here is a lifeboat station. Behind the shore of the bay is West Lake, in which are several islands.

Little Sandy Bay is between West and Wicked points and inshore of this bay is East Lake. Both West and Wicked points have reefs extending from them, that from Wicked Point being extensive and extending over 2 (2¼) miles in a southwesterly direction and about the same distance alongshore to the eastward.

Wicked, or Salmon, Point Light, fixed red, is shown on extremity of point from a white, square lighthouse with dwelling attached. It is 40 feet above the lake level and visible 8 (9¼) miles.

Soup Harbor is between Wicked and Peter points. It has a small lake at its head.

Peter Point, the most southerly point of Prince Edward Island, has a reef extending from it to the southward. This reef is about 1¼ (1½) miles broad, surrounding Peter Point, and extends directly south to a point, the southern extremity being 1¼ (1½) miles south of Peter Point.

Peter Point Light, revolving white every 35 seconds, is 62 feet above the lake level and is visible 13 (15) miles. The light building is a white, circular tower.

Fog Signal.—Close in front of the tower, 16 feet above the water, is a steam fog horn, which in foggy weather gives blasts of 9 seconds, with silent intervals of 28 seconds. The building is white, with brown roof.

Gull Point, next east of Peter Point, has a reef extending from it for nearly a mile. The shore of Prince Edward between Gull and South Bay points is slightly indented and in places lined with rocky reefs.

South Bay Point is the SE. extremity of Prince Edward Island. Off it are Timber and False Duck islands, both of which are nearly connected to the point by shoals.

Shoal.—SSE. 1¼ (1½) miles from South Bay Point light is a detached 12-foot shoal.

South Bay Point Light.—On Point Traverse from a white, square lighthouse, dwelling attached, is shown, 36 feet above the lake level, a fixed red light visible 10 (11½) miles.

False Duck Island Light, fixed white, is shown on the eastern point of the island, 68 feet above the lake level, and is visible 13 (15) miles.

Fog Signal.—A hand horn answers signals from vessels.

William Shoal, 12 feet water, and **Harris Shoal,** 22 feet water, lie between False Duck and Main Duck islands, leaving a clear channel of 3½ (4) miles between Harris Shoal and the Main Duck.

Main Duck Island is a narrow island nearly 2 (2¼) miles east and west. The whole southern shore is lined with shoals and reefs, and this shore, as well as the western point of the island, should not be approached nearer than a mile.

Yorkshire Island.—From the east point of Main Duck Island a shoal extends over a mile in a northeasterly direction, and on this shoal is Yorkshire Island.

Between Yorkshire and Galloo islands is a wide and deep passage, with no danger except Galloo Shoal, lying a mile west of Galloo Island light. This shoal is buoyed, but has been the cause of many wrecks.

Prince Edward, or South, Bay, a deep indentation in Prince Edward Island, lies between South Bay and Pleasant (Indian) points.

Flats Point is in the southwestern part of Prince Edward Bay. There is a life-boat station on the point next east of Flats. Waupoos Island and Green Island lie in Prince Edward Bay on its northern shore. North of Green Island is Cape Vesey, and from this cape to Pleasant (Indian) Point the shore of Prince Edward is steep-to and can be safely approached. Both the north and south shores of the bay are formed by long, narrow peninsulas extending NE. and easterly from Prince Edward Island.

Pleasant (Indian) Point Light, at entrance to Adolphus Reach, Bay of Quinte, is fixed white, 52 feet above the lake level, and visible 10 (11½) miles. The light is shown from a white, octagonal building with red lantern.

Big Bar Shoal, detached and with 18 feet over it, lies 4½ (5⅛) miles ESE. ¾ E. from Pleasant Point light.

Murray Canal is a straight cut, without locks, 6⅛ statute miles long between extremities of piers, 80 feet wide on the bottom and 12 feet deep, below the ordinary low-water level of Lake Ontario, joining Presqu' Ile Harbor with the Bay of Quinte. Its axis is ENE. and WSW. and it is crossed by one railway and three highway bridges. At each end of the canal, cribwork piers have been built on either side into the shallow water, and beyond them channels dredged 200 feet wide have been continued until water of the same depth as that in the canal was reached. The dredged cut at the east end extends 2,300 feet beyond the ends of the piers and is for its whole length in the axis of the canal.

By day the center of the swings of the bridges, and by night the lights on the same (white if swings are open, red if closed), in range, will indicate with sufficient accuracy the middle of the dredged channel and of the canal. Each bridge is passed to the southward of the swing, which is somewhat to the northward of the axis of the canal.

MURRAY CANAL LIGHTS.

On the north pier, 30 feet from the outer end, west entrance to canal, is a fixed red light, 14 feet above the lake level and visible 4 (4½) miles.

Above the center of the swing pier of Lovatt's Bridge, 6,490 feet from west entrance to canal, is a fixed white and red light, 35 feet above lake level and visible 6 (7) miles.

Above the center pier of Smithfield bridge, 7,700 feet east from preceding, is a fixed white and red light, 35 feet above lake level and visible 6 (7) miles.

Above the center of the swing pier of the Central Ontario Railway bridge, 6,600 feet from the preceding, is a fixed white and red light, 20 feet above the lake level and visible 4 (4½) miles.

Above the center of the swing pier of the Carrying Place Highway bridge, 1,500 feet east of the preceding, is a fixed white and red light, 35 feet above the lake level and visible 6 (7) miles.

On the north pier, 30 feet from outer end, at east entrance to Murray Canal, is a fixed red light, 19 feet above the lake level and visible 4 (4½) miles.

Bay of Quinte.—The name is applied to all the waters north of Prince Edward Island which separate it from the mainland, although the bay proper, apparently, is the large indentation in the northern and central part of the island. The bay is connected with Presqu' Ile Harbor and Lake Erie by the Murray Canal on the west, and with Lake Erie and the St. Lawrence River by Adolphus and North channels on the east. On the north shore of the bay the Trent, Moira, Salmon, and Napanee rivers empty. East of the Napanee River is Casey Point, and between it and Barker Point is a narrow inlet known as Hay Bay. The channel north of Pleasant Point is Adolphus Reach, which, with North Channel, leads into the north branch of the St. Lawrence River. Adolphustown is at the west end of Adolphus Reach, and Collins Bay at the east end of the North Channel. Trenton near the mouth of the Trent River, Belleville at the mouth of the Moira River, Shannonville near the mouth of the Salmon River, and Deseronto at the mouth of the Napanee River are the principal towns on the north shore of Quinte Bay. On the south shore of the bay, west of Green Point, are Big and other islands.

Trenton, at the mouth of the Trent River, has a good, but not large harbor; the depth of water varies, but it usually averages 11 feet. There

is a bar along the west bank of the river, and vessels approaching keep well to the east and approach in a line about the center of the river. There are buoys after turning to the east going down the Bay of Quinte toward Belleville. Between Trenton and Belleville a bar stretches along the middle of the bay, and vessels usually keep along the south shore. There is a current of about 2 knots an hour in the bay except during heavy west winds. The prevailing winds in summer are SW. No port charges or pilotage.

Storm Signals are shown at the outside lumber wharf on east side of river.

Hallowell Bay, at the head of which is Picton, is east of Green Point and opposite Barker Point, on the main shore.

QUINTE BAY LIGHTS.

Nigger Island Shoal Light is fixed white, 27 feet above the bay level and visible 10 (11½) miles. The lighthouse is a square tower, surmounted by a square lantern, the whole painted white. It is 27 feet in height from the deck of the pier to the top of the lantern. It stands on a crib-work pier, sunk in 11 feet of water, on the north side of the steamboat channel and near the western extremity of the shoal running southwestwardly from Nigger Island toward Potters Island.

Directions.—Vessels upon leaving the swing of the Belleville bridge, bound up, can steer directly for the light on a course WSW. (S. 67° 30′ W.) and should pass the light, leaving it about 300 feet on the north side or starboard hand. Vessels leaving the Murray Canal, bound down, after passing the red buoy off Onderdonk Shoal can also steer directly for the light on a course NE. (N. 45° E.). When within 4,000 feet of it they should open it half a point on the starboard bow, so as to clear the north extreme of the shoal extending from Potters Island. At 2,000 feet distant they should change their course so as to pass it, leaving it 300 feet to the northward, or on the port hand, and, after passing the most easterly black buoy on Potters Island shoal, can shape their course directly for the swing of Belleville bridge.

Bay of Quinte Bridge Light, immediately west of Belleville, is fixed white south of southern opening; fixed white north of northern opening; red light at each end of drawspan when bridge is closed; two green lights at each end of drawspan when bridge is open. The light is 18 feet above the bay level and is visible 3 (3½) miles. The center pier of swing span is 195 feet from the south, or Prince Edward County, shore. A channel 100 feet wide both north and south of swing pier. When draw is open 2 green lights, flanked by 2 white lights, will be seen, and vessels must pass between a green and a white light. Maintained by Bridge Company.

Belleville Light.—On the SE. edge of shoal, at entrance to the Belleville Harbor, is a fixed white light, 38 feet above the bay level and visible 11 (12¾) miles.

Telegraph Island Light, between Trident Point and Deseronto, is fixed white, 46 feet above the bay level and visible 12 (13¾) miles.

Deseronto Light, fixed white, is shown from square tower on roof of freight shed on the railway wharf. The light is 44 feet above the bay level, visible 11 (12¾) miles and serves as a guide to Deseronto from Belleville, Picton, and Napanee.

Amherst Island, a large island on the south side of North Channel, is 9 (10½) miles NE. and SW., and about 3 (3½) miles north and south through its center. Pig Point is the west point of the island and is steep-to, as is the whole north shore to the shoal extending north over 1¼ (1½) miles from the NE. end of the island. This shoal is a mile broad and on it are several islets; the outer ones are Brother and Center Brother Islands; the bar is ¼ mile from the point. Amherst Bay is an indentation on the south shore of Amherst Island. The west point of this bay is surrounded by reefs, and a short distance off is Lagoon Island. Emeric Point, the east point of Amherst Bay and the SE. point of the island, is also shoal, and off it is Nut Island. The little bay inside of Nut Island is shoal and rocky. The eastern shore of Amherst Island is shoal, and in places there are outlying shoals about ¾ mile off shore.

Salmon Island, ESE. ½ E. 1½ (1⅝) miles from Brother Island, is on the northern part of a large shoal, which is almost connected with the shoal from Amherst Island; it extends south, SE., and SW. from Salmon Island for about ¾ mile. Vessels should not attempt to pass south or west of Salmon Island.

Center Brother Island Light.—On the northernmost point of the island, from a white, square lighthouse with red lantern, is shown, 31 feet above the lake level, a fixed white light, visible 10 (11½) miles.

Outlying Shoals.—Halfway between the NE. end of Amherst Island and Simcoe Island is the center of an extensive shoal, least water 4 feet. From its center the shoal extends ⅝ mile NE. and SW., and is the same distance broad. East of this shoal ⅝ mile is a small shoal, least water 15 feet, which lies one (1¼) mile SW. of Snake Island light. By keeping Nine-Mile (Gage) Point and Pigeon Island lights in line, a vessel will clear both shoals, but passes close to the SW. edge of the smaller.

Shoal.—East 2 (2⅓) miles from Center Brother Island light is a 15-foot shoal (unmarked), which lies ¼ mile off shore.

Kingston, at the mouth of the St. Lawrence, is on the Great Cataraqui River. It is of importance as a naval station, is fortified, and commands the entrance of the Rideau Canal.

Kingston Harbor has depths of from 12 to 15 feet. There is good anchorage off the shipyard.

Directions.—The best approach from the west is west of Snake Island and close alongshore inside of the two 12-foot shoals, marked by beacon buoys, lying off the city about ½ mile. In approaching from the eastward the main shore should be kept aboard to avoid the 11-foot shoal, marked by beacon buoy, a mile west of Browns Point light.

Leading Marks.—Barryfield Range lights and targets in line carry clear of shoals to Kingston.

Storm Signals are shown from staff on Folgers Wharf.

Kingston Light, a fixed white gas light, is shown from the City Hall clock. It is visible 9 (10½) miles.

RANGE LIGHTS.

Front.—East 370 feet from the end of Kingston bridge is a fixed white light, 48 feet above the river level and visible 12 (14) miles. It is shown from a red tripod with white oval beacon at its top and brown shed at its base.

Rear.—Fifteen hundred feet NE. ⅛ N. (N. 35° 09′ E.) from the front light is shown from a similar lighthouse, 75 feet above the river level, a fixed white light, visible 12 (14) miles. The lights show over a small arc on each side of the alignment, which leads inside of Carruthers and Point Frederick shoals.

Point Frederick (fortified) separates Kingston Harbor from Navy Bay, which is shoal; and Point Henry, also fortified, separates Navy from Dead Man Bay. Cedar Island lies off Dead Man Bay.

For the south shore and Browns (Knapps) Point light, see page 80.

CHAPTER IX.

RULES OF THE ROAD.

FOR THE GREAT LAKES AND THEIR CONNECTING AND TRIBUTARY WATERS AS FAR EAST AS MONTREAL.

APPROVED, FEBRUARY 8, 1895.

"ALL LAWS OR PARTS OF LAWS, SO FAR AS APPLICABLE TO THE NAVIGATION OF THE GREAT LAKES AND THEIR CONNECTING AND TRIBUTARY WATERS AS FAR EAST AS MONTREAL, INCONSISTENT WITH THE FOREGOING RULES ARE HEREBY REPEALED.

"THAT THIS ACT SHALL TAKE EFFECT ON AND AFTER MARCH FIRST, EIGHTEEN HUNDRED AND NINETY-FIVE."

SEE RULE 28, ARTICLES 4 AND 5.

[PUBLIC—NO. 41.]

An Act to regulate navigation on the Great Lakes and their connecting and tributary waters.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following rules for preventing collisions shall be followed in the navigation of all public and private vessels of the United States upon the Great Lakes and their connecting and tributary waters as far east as Montreal.

STEAM AND SAIL VESSELS.

RULE 1. Every steam vessel which is under sail and not under steam, shall be considered a sail vessel; and every steam vessel which is under steam, whether under sail or not, shall be considered a steam vessel. The word steam vessel shall include any vessel propelled by machinery. A vessel is under way within the meaning of these rules when she is not at anchor or made fast to the shore or aground.

LIGHTS.

RULE 2. The lights mentioned in the following rules and no others shall be carried in all weathers from sunset to sunrise. The word visible in these rules when applied to lights shall mean visible on a dark night with a clear atmosphere.

RULE 3. Except in the cases hereinafter expressly provided for, a steam vessel when under way shall carry:

(*a*) On or in front of the foremast, or if a vessel without a foremast, then in the fore part of the vessel, at a height above the hull of not less than twenty feet, and if the beam of the vessel exceeds twenty feet, then at a height above the hull not less than such beam, so, however, that such height need not exceed forty feet, a bright white light so constructed as to show an unbroken light over an arc of the horizon of twenty points of the compass, so fixed as to throw the light ten points on each side of the vessel, namely, from right ahead to two points abaft the beam on either side, and of such character as to be visible at a distance of at least five miles.

(*b*) On the starboard side, a green light, so constructed as to throw an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the starboard side, and of such a character as to be visible at a distance of at least two miles.

(*c*) On the port side, a red light, so constructed as to show an unbroken light over an arc of the horizon of ten points of the compass, so fixed as to throw the light from right ahead to two points abaft the beam on the port side, and of such a character as to be visible at a distance of at least two miles.

(*d*) The said green and red lights shall be fitted with inboard screens projecting at least three feet forward from the light, so as to prevent these lights from being seen across the bow.

(*e*) A steamer of over one hundred and fifty feet register length shall also carry when under way an additional bright light similar in construction to that mentioned in subdivision (*a*), so fixed as to throw the light all around the horizon and of such character as to be visible at a distance of at least three miles. Such additional light shall be placed in line with the keel at least fifteen feet higher from the deck and more than seventy-five feet abaft the light mentioned in subdivision (*a*).

VESSELS TOWING.

RULE 4. A steam vessel having a tow other than a raft shall in addition to the forward bright light mentioned in subdivision (*a*) of rule three carry in a vertical line not less than six feet above or below that light a second bright light of the same construction and character and fixed and carried in the same manner as the forward bright light mentioned in said subdivision (*a*) of rule three. Such steamer shall also carry a small bright light abaft the funnel or after mast for the tow to steer by, but such light shall not be visible forward of the beam.

RULE 5. A steam vessel having a raft in tow shall, instead of the forward lights mentioned in rule four, carry on or in front of the foremast,

or if a vessel without a foremast then in the fore part of the vessel, at a height above the hull of not less than twenty feet, and if the beam of the vessel exceeds twenty feet, then at a height above the hull not less than such beam, so however that such height need not exceed forty feet, two bright lights in a horizontal line athwartships and not less than eight feet apart, each so fixed as to throw the light all around the horizon and of such character as to be visible at a distance of at least five miles. Such steamer shall also carry the small bright steering light aft, of the character and fixed as required in rule four.

RULE 6. A sailing vessel under way and any vessel being towed shall carry the side lights mentioned in rule three.

A vessel in tow shall also carry a small bright light aft, but such light shall not be visible forward of the beam.

RULE 7. The lights for tugs under thirty tons register whose principal business is harbor towing, and for boats navigating only on the River Saint Lawrence; also ferryboats, rafts, and canal boats, shall be regulated by rules which have been or may hereafter be prescribed by the Board of Supervising Inspectors of Steam Vessels.

RULE 8. Whenever, as in the case of small vessels under way during bad weather, the green and red sidelights can not be fixed, these lights shall be kept at hand lighted and ready for use, and shall, on the approach of or to other vessels, be exhibited on their respective sides in sufficient time to prevent collision, in such manner as to make them most visible, and so that the green light shall not be seen on the port side, nor the red light on the starboard side, nor, if practicable, more than two points abaft the beam on their respective sides. To make the use of these portable lights more certain and easy, they shall each be painted outside with the color of the light they respectively contain, and shall be provided with suitable screens.

RULE 9. A vessel under one hundred and fifty feet register length, when at anchor, shall carry forward, where it can best be seen, but at a height not exceeding twenty feet above the hull, a white light in a lantern constructed so as to show a clear, uniform, and unbroken light, visible all around the horizon, at a distance of at least one mile.

A vessel of one hundred and fifty feet or upward in register length, when at anchor, shall carry in the forward part of the vessel, at a height of not less than twenty and not exceeding forty feet above the hull, one such light, and at or near the stern of the vessel, and at such a height that it shall be not less than fifteen feet lower than the forward light, another such light.

RULE 10. Produce boats, canal boats, fishing boats, rafts, or other water craft navigating any bay, harbor, or river by hand power, horse power, sail, or by the current of the river, or which shall be anchored or moored

in or near the channel or fairway of any bay, harbor, or river, and not otherwise provided for in these rules, shall carry one or more good white lights, which shall be placed in such manner as shall be prescribed by the Board of Supervising Inspectors of Steam Vessels.

RULE 11. Open boats shall not be obliged to carry the side lights required for other vessels, but shall, if they do not carry such lights, carry a lantern having a green slide on one side and a red slide on the other side; and on the approach of or to other vessels, such lantern shall be exhibited in sufficient time to prevent collision, and in such a manner that the green light shall not be seen on the port side, nor the red light on the starboard side. Open boats, when at anchor or stationary, shall exhibit a bright white light. They shall not, however, be prevented from using a flare-up in addition if considered expedient.

RULE 12. Sailing vessels shall at all times, on the approach of any steamer during the nighttime, show a lighted torch upon that point or quarter to which such steamer shall be approaching.

RULE 13. The exhibition of any light on board of a vessel of war or revenue cutter of the United States may be suspended whenever, in the opinion of the Secretary of the Navy, the commander in chief of a squadron, or the commander of a vessel acting singly, the special character of the service may require it.

FOG SIGNALS.

RULE 14. A steam vessel shall be provided with an efficient whistle, sounded by steam or by some substitute for steam, placed before the funnel not less than eight feet from the deck, or in such other place as the local inspectors of steam vessels shall determine, and of such character as to be heard in ordinary weather at a distance of at least two miles, and with an efficient bell, and it is hereby made the duty of the United States local inspectors of steam vessels when inspecting the same to require each steamer to be furnished with such whistle and bell. A sailing vessel shall be provided with an efficient fog horn and with an efficient bell.

Whenever there is thick weather by reason of fog, mist, falling snow, heavy rainstorms, or other causes, whether by day or by night, fog signals shall be used as follows:

(*a*) A steam vessel under way, excepting only a steam vessel with raft in tow, shall sound at intervals of not more than one minute three distinct blasts of her whistle.

(*b*) Every vessel in tow of another vessel shall, at intervals of one minute, sound four bells on a good and efficient and properly placed bell as follows: By striking the bell twice in quick succession, followed by a little longer interval, and then again striking twice in quick succession (in the manner in which four bells is struck in indicating time).

(*c*) A steamer with a raft in tow shall sound at intervals of not more than one minute a screeching or Modoc whistle for from three to five seconds.

(*d*) A sailing vessel under way and not in tow shall sound at intervals of not more than one minute—

If on the starboard tack with wind forward of abeam, one blast of her fog horn;

If on the port tack with wind forward of the beam, two blasts of her fog horn;

If she has the wind abaft the beam on either side, three blasts of her fog horn.

(*e*) Any vessel at anchor and any vessel aground in or near a channel or fairway shall at intervals of not more than two minutes ring the bell rapidly for three to five seconds.

(*f*) Vessels of less than ten tons registered tonnage, not being steam vessels, shall not be obliged to give the above-mentioned signals, but if they do not they shall make some other efficient sound signal at intervals of not more than one minute.

(*g*) Produce boats, fishing boats, rafts, or other water craft navigating by hand power or by the current of the river, or anchored or moored in or near the channel or fairway and not in any port, and not otherwise provided for in these rules, shall sound a fog horn, or equivalent signal, at intervals of not more than one minute.

RULE 15. Every vessel shall, in thick weather, by reason of fog, mist, falling snow, heavy rainstorms, or other causes, go at moderate speed. A steam vessel hearing, apparently not more than four points from right ahead, the fog signal of another vessel shall at once reduce her speed to bare steerageway, and navigate with caution until the vessels shall have passed each other.

STEERING AND SAILING RULES.

SAILING VESSELS.

RULE 16. When two sailing vessels are approaching one another so as to involve risk of collision one of them shall keep out of the way of the other, as follows, namely:

(*a*) A vessel which is running free shall keep out of the way of a vessel which is closehauled.

(*b*) A vessel which is closehauled on the port tack shall keep out of the way of a vessel which is closehauled on the starboard tack.

(*c*) When both are running free, with the wind on different sides, the vessel which has the wind on the port side shall keep out of the way of the other.

(*d*) When they are running free, with the wind on the same side, the vessel which is to windward shall keep out of the way of the vessel which is to leeward.

STEAM VESSELS.

RULE 17. When two steam vessels are meeting end on, or nearly end on, so as to involve risk of collision each shall alter her course to starboard, so that each shall pass on the port side of the other.

RULE 18. When two steam vessels are crossing so as to involve risk of collision the vessel which has the other on her own starboard side shall keep out of the way of the other.

RULE 19. When a steam vessel and a sailing vessel are proceeding in such directions as to involve risk of collision the steam vessel shall keep out of the way of the sailing vessel.

RULE 20. Where, by any of the rules herein prescribed, one of two vessels shall keep out of the way, the other shall keep her course and speed.

RULE 21. Every steam vessel which is directed by these rules to keep out of the way of another vessel shall, on approaching her, if necessary, slacken her speed or stop or reverse.

RULE 22. Notwithstanding anything contained in these rules every vessel overtaking any other shall keep out of the way of the overtaken vessel.

RULE 23. In all weathers every steam vessel under way in taking any course authorized or required by these rules shall indicate that course by the following signals on her whistle, to be accompanied whenever required by corresponding alteration of her helm; and every steam vessel receiving a signal from another shall promptly respond with the same signal or, as provided in rule twenty-six:

One blast to mean, "I am directing my course to starboard."

Two blasts to mean, "I am directing my course to port." But the giving or answering signals by a vessel required to keep her course shall not vary the duties and obligations of the respective vessels.

RULE 24. That in all narrow channels where there is a current, and in the rivers Saint Mary, Saint Clair, Detroit, Niagara, and Saint Lawrence, when two steamers are meeting, the descending steamer shall have the right of way, and shall, before the vessels shall have arrived within the distance of one-half mile of each other, give the signal necessary to indicate which side she elects to take.

RULE 25. In all channels less than five hundred feet in width, no steam vessel shall pass another going in the same direction unless the steam vessel ahead be disabled or signify her willingness that the steam vessel astern shall pass, when the steam vessel astern may pass, subject, however, to the other rules applicable to such a situation. And when steam vessels proceeding in opposite directions are about to meet in such channels, both such vessels shall be slowed down to a moderate speed, according to the circumstances.

RULE 26. If the pilot of a steam vessel to which a passing signal is sounded deems it unsafe to accept and assent to said signal, he shall not sound a cross signal; but in that case, and in every case where the pilot of one steamer fails to understand the course or intention of an approaching steamer, whether from signals being given or answered erroneously, or from other causes, the pilot of such steamer so receiving the first passing signal, or the pilot so in doubt, shall sound several short and rapid blasts of the whistle; and if the vessels shall have approached within half a mile of each other both shall reduce their speed to bare steerageway, and, if necessary, stop and reverse.

RULE 27. In obeying and construing these rules due regard shall be had to all dangers of navigation and collision and to any special circumstances which may render a departure from the above rules necessary in order to avoid immediate danger.

RULE 28. Nothing in these rules shall exonerate any vessel, or the owner or master or crew thereof, from the consequences of any neglect to carry lights or signals, or of any neglect to keep a proper lookout, or of a neglect of any precaution which may be required by the ordinary practice of seamen, or by the special circumstances of the case.

SEC. 2. That a fine not exceeding two hundred dollars, may be imposed for the violation of any of the provisions of this Act. The vessel shall be liable for the said penalty, and may be seized and proceeded against, by way of libel, in the district court of the United States for any district within which such vessel may be found.

SEC. 3. That the Secretary of the Treasury of the United States shall have authority to establish all necessary regulations, not inconsistent with the provisions of this Act, required to carry the same into effect.

The Board of Supervising Inspectors of the United States shall have authority to establish such regulations to be observed by all steam vessels in passing each other, not inconsistent with the provisions of this Act, as they shall from time to time deem necessary; and all regulations adopted by the said Board of Supervising Inspectors under the authority of this Act, when approved by the Secretary of the Treasury shall have the force of law. Two printed copies of any such regulations for passing, signed by them, shall be furnished to each steam vessel, and shall at all times be kept posted up in conspicuous places on board.

SEC. 4. That all laws or parts of laws, so far as applicable to the navigation of the Great Lakes and their connecting and tributary waters as far east as Montreal, inconsistent with the foregoing rules are hereby repealed.

SEC. 5. That this Act shall take effect on and after March first, eighteen hundred and ninety-five.

Approved, February 8, 1895.

CHAPTER X.

SIGNALS.

UNITED STATES AND CANADA.

INFORMATION SIGNALS.

Information signals displayed at stations on the Great Lakes indicate the expected direction of the wind, whether easterly or westerly. The red pennant will be used to indicate easterly winds, and the white pennant westerly winds. Orders to hoist these signals will specify the expected direction. Attention is called to the fact that the information signal when used at Lake stations is not a notification that a storm is expected at other Lake stations, but as warning that winds dangerous to tows and small vessels may occur at the station displaying this signal.

HURRICANE SIGNAL.

This signal consists of two red flags with black centers, displayed one above the other, and will be used to announce the expected approach of tropical hurricanes, and also of those extremely severe and dangerous storms which occasionally move across the Lakes and the northern Atlantic coast.

The flags are the same as the one used for the distinctive storm signal, the pennants being omitted. No distinctive night hurricane signal is displayed, but when this signal is ordered during the day and is not lowered or changed before dark, the night storm signal will be displayed, the direction to be determined by the information contained in the message accompanying the order to hoist.

SIGNALS OF DISTRESS.

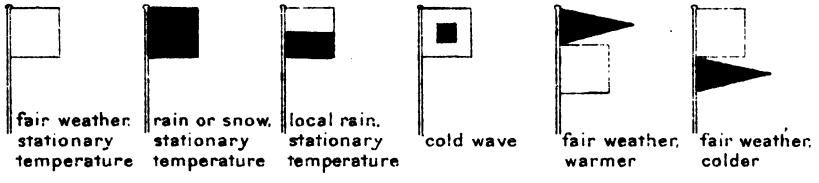
The Board of Trade gives notice that on and after the first of November, 1873, the following signals shall, in accordance with the 18th section of the Merchant Shipping Act, 1873, be deemed to be signals of distress:

In the Daytime.—The following signals, numbered 1, 2, and 3, when used or displayed together or separately, shall be deemed to be signals of distress in the daytime:

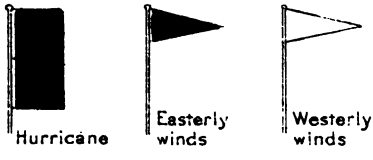
"1. A gun fired at intervals of about a minute.

"2. The International Code Signal of Distress, indicated N. C.

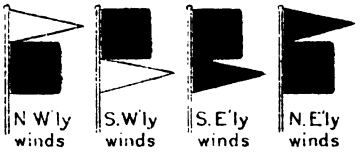
U.S. WEATHER AND TEMPERATURE SIGNALS


fair weather, stationary temperature
rain or snow, stationary temperature
local rain, stationary temperature
cold wave
fair weather, warmer
fair weather, colder
warmer weather, rain or snow
colder weather, rain or snow
warmer weather with local rains
colder weather with local rains
fair weather, cold wave
wet weather, cold wave

U.S. INFORMATION SIGNALS



U.S. STORM SIGNALS

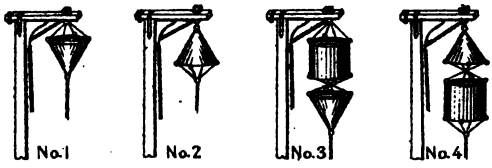


Flags 8 feet square. Pennants 5 feet hoist and 12 feet fly.
White centers 4 feet square, black centers 3 feet square.

The Hurricane Signal indicates the expected approach of a tropical hurricane or of one of the dangerous storms which occasionally move across the lakes.
The Storm Signal indicates that the storm is expected to be of marked violence and dangerous to all classes of vessels.
The pennants when displayed alone indicate the expected direction of the wind.
NIGHT SIGNALS — *By night a red light will indicate easterly winds and a white light above a red light, westerly winds.*

CANADIAN STORM SIGNALS

DAY SIGNALS



Day Signal	If displayed on Lakes Superior Erie or Ontario indicates:	If displayed on Lake Huron or in Georgian Bay indicates:
No. 1	a moderate gale is expected at first from an Easterly direction.	a moderate gale is expected at first from a Southerly direction.
No. 2	a heavy gale is expected at first from a Westerly direction.	a heavy gale is expected at first from a Northerly direction.
No. 3	a heavy gale is expected at first from an Easterly direction.	a heavy gale is expected at first from a Southerly direction.
No. 4	a heavy gale is expected at first from a Westerly direction.	a heavy gale is expected at first from a Northerly direction.

The Cone when displayed alone indicates that it is expected that the wind will attain a velocity of 25 miles an hour, but will not exceed 35 miles, and it is not intended to indicate that an ordinary, wellfound vessel should stay in port but is simply a warning that strong winds are expected from the quarter indicated.

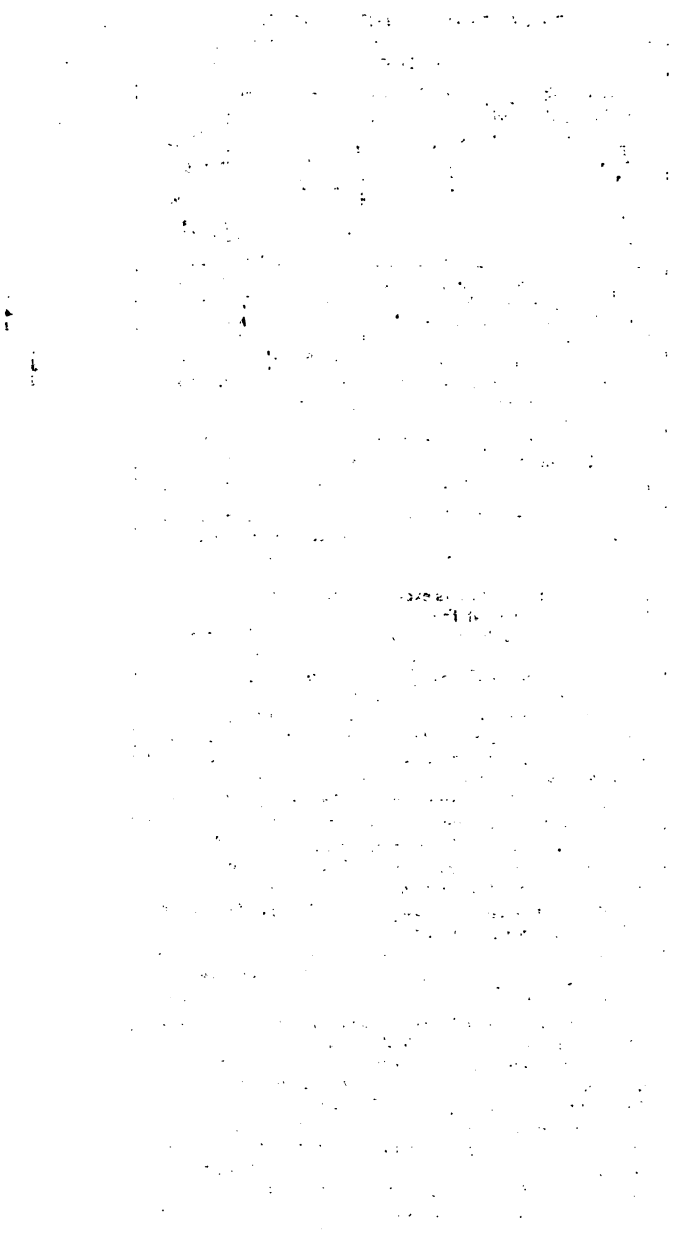
The Drum will always be hoisted when the velocity of the wind is expected to exceed 35 miles an hour.

NIGHT SIGNALS

The Night Signal corresponding to Day Signals Nos. 1 and 3 is two lanterns hanging one above the other.

The Night Signal corresponding to Day Signals Nos. 2 and 4 is two lanterns hanging side by side.

October and November are the months in which severe storms most frequently occur on the Lakes. In these fall storms on lakes Erie and Ontario, the wind almost invariably commences at the southeast and works round through south to west and northwest, and the time of the hardest blow is usually when the barometer begins to rise as the wind gets around to the west. On Lake Huron and in Georgian Bay, the wind, though for the most part changing as on the Lower Lakes, not unfrequently changes with great suddenness, chopping after a lull from south-southeast to northwest, and blowing hardest, as a rule, from the northwest.



"The Distant Signal, consisting of a square flag, having either above or below it a ball, or anything resembling a ball.

"**At Night.**—The following signals, numbered 1, 2, and 3, when used or displayed together or separately, shall be deemed to be signals of distress at night:

"1. A gun fired at intervals of about a minute.

"2. Flames on the ship (as from a burning tar barrel, oil barrel, etc).

"Rockets or shells of any color or description, fired one at a time, at short intervals."

And "any master of a vessel who uses or displays, or causes or permits any person under his authority to use or display any of the said signals, except in the case of a vessel being in distress, shall be liable to pay compensation for any labor undertaken, risk incurred, or loss sustained in consequence of such signal having been supposed to be a signal of distress, and such compensation may, without prejudice to any other remedy, be recovered in the same manner in which salvage is recoverable."

CHAPTER XI.

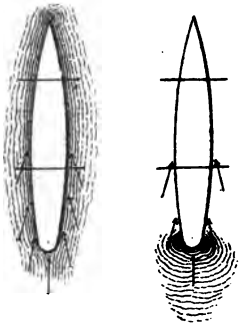
BRIEF RULES FOR THE USE OF OIL.

BRIEF RULES FOR THE USE OF OIL TO PROTECT VESSELS IN STORMY WATERS.

From the prize essay submitted to the Hamburg Nautical School by Captain R. Karlowa of the Hamburg American Steamship Company.

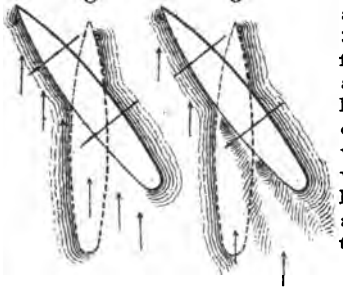
In the illustrative figures, the flowing lines represent the spreading oil and the arrows denote the direction of the wind and sea.

Fig. 1 Fig. 2



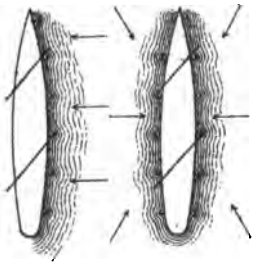
Scudding before a gale, figure 1, distribute oil from the bow by means of oil-bags or through waste-pipes, it will thus spread aft and give protection both from quartering and following seas.
If only distributed astern, figure 2, there will be no protection from the quartering sea.

Fig. 3 Fig. 4



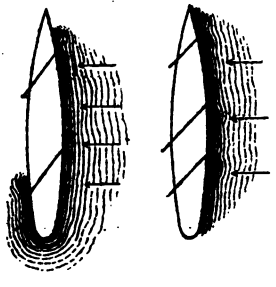
Running before a gale, yawing badly and threatening to broach-to, figures 3 and 4, oil should be distributed from the bow and from both sides, abaft the beam.
In, figure 3, for instance where it is only distributed at the bow, the weather quarter is left unprotected when the ship yaws.
In, figure 4, however, with oil-bags abaft the beam as well as forward, the quarter is protected.

Fig. 5 Fig. 6



Lying-to, figure 5, a vessel can be brought closer to the wind by using one or two oil-bags forward, to windward. With a high beam sea, use oil-bags along the weather side at intervals of 40 or 50 feet.
In a heavy cross-sea, figure 6, as in the center of a hurricane, or after the center has passed, oil-bags should be hung out at regular intervals along both sides.

Fig. 7 Fig. 8



Drifting in the trough of a heavy sea, figures 7, and 8, use oil from waste-pipes forward and bags on weather side, as in figure 8.
These answer the purpose very much better than one bag at weather bow and one at lee quarter, although this has been tried with some success, see figure 7.

CHAPTER XII.

ANCHORING AND RIDING OUT GALES IN DEEP WATER.

A general rule for anchoring is to give a scope of chain three times the depth of the water, but a safer rule is to give five or even six times the depth.

In anchoring, it is desirable to lay the chain out straight, clear of the anchor. This can be accomplished by keeping headway, or by giving the vessel sternboard before letting go.

If anchoring in deep water it is best to lower the anchor into the water until its weight is taken by the chain, and then let go from the stopper inboard. In cases of anchoring in very deep water it is well to ease the anchor down to within ten or twenty fathoms of the bottom before letting go; by doing this, command can be retained over the chain, and there is less danger of losing it.

A long scope of chain acts as a buffer against the strain of sudden jerks on the anchor and chain, caused by the ship veering about, and rising or falling to the waves. The longer the scope the greater the resistance to this disturbing power.

To increase the value of the long scope a heavy kedge, or other weight, may be secured to the bight of the cable; then veer out more chain; this will bring the strain more in a horizontal direction at the anchor and prevent the latter from tripping.

North Sea fishermen, in their small vessels, use a large cask on their cables during gales of wind, secured between the vessel and the anchor, in order to reduce the direct strain on the ground tackle.

It is recommended to use an empty cask for this purpose, in case of need, and if arrangements are made for running out oil bags to the same before it is launched, the force of the sea will be much reduced, as shown in the article on the subject of oil.

This barrel buoy serves two purposes; the vessel in veering about rides more directly from the barrel buoy than from the anchor itself; hence there is less disturbing force brought upon the anchor, and less probability of fouling it.

By taking up the strain of the chain as the vessel rides up, it guards against the quick-snapping action on the chain when the vessel tautens it

out again, the buoy being dragged through the water counteracting in part this strain.

During the war of the rebellion it was a common practice for vessels on blockading duty to ride out heavy gales of wind at sea, and on a lee shore, while at anchor, with a long scope of chain, and without using oil. Admiral Porter's reports of the operations against Fort Fisher, on the coast of North Carolina, mention numerous instances of severe gales being encountered while at anchor at that point without any accident.

EXTRACTS

from the log books of several vessels during the gale of December 20 and 21, 1864, off Beaufort, North Carolina.

U. S. S. *Brooklyn:* On December 15, anchored with starboard anchor in 15 fathoms of water, veered to 45 fathoms of chain. On December 20 and 21 the wind freshened gradually to a fresh gale from the SW. and a heavy sea made. Early on the morning of the 21st, veered to 75 fathoms and at noon to 100 fathoms. Started engines ahead slow to ease chain. Heavy sea. Ship rolling heavily. Force of wind 7-9. On the 23d, the gale abating, hove in to 50 fathoms.

U. S. S. *Colorado:* Anchored on December 15, in 16 fathoms of water, veered to 60 fathoms of chain on starboard anchor. December 21, fresh gale, veered to 135 fathoms and started engines ahead slow. December 23, hove up starboard anchor and found the arms broken; let go port anchor.

U. S. S. *Tuscarora:* Anchored December 19, in 10 fathoms, veered to 55 fathoms on starboard chain. December 21, ship dragging, veered to 90 fathoms and steamed ahead slow. December 22, got underway, anchoring later in 11 fathoms with 90 fathoms of chain.

U. S. S. *Juniata:* Anchored in 13 fathoms of water with 45 fathoms of chain on starboard anchor, on December 19. On the 20th, a fresh gale blowing, with heavy sea running, veered to 60 fathoms. On the 21st, started to veer more chain. In veering parted stoppers, compressor bolt broke, and not being able to stop the chain, it tore the bolt out of the keelson and parted the end lashing, thereby losing 150 fathoms of chain and an anchor weighing 2,450 pounds. Got under way and stood out. Saw that nearly all the vessels in the fleet had dragged or were dragging their anchors. Twenty-second, anchored at 10 A. M. in 14 fathoms of water with 75 fathoms of chain on port anchor.

These vessels were out of sight of land and on a lee shore.

CHAPTER XIII.

CURRENTS.

Extract from the "Currents of the Great Lakes, as deduced from the movements of Bottle Papers during the seasons of 1892 and 1893," by Mark W. Harrington, Chief of the Weather Bureau.

The currents in the Great Lakes are grouped under three heads:

1. The main currents:

A general set of the water toward the outlet exists in each of the Great Lakes, forming a continuous current in that direction.

The outlet of Lake Superior being on the southern side, this current hugs the southern shore. In Lake Michigan it hugs the eastern shore, the readiest access to the outlet being on that side, owing to the position of the islands at its northern end. The same rule holds good in Lake Huron as regards the western shore. In Lakes Erie and Ontario this phenomenon is not so plainly marked.

2. Surface currents:

These are due to the prevailing winds which have always been recognized as influencing the motion of currents in large bodies of water.

3. Return currents:

The outlets of the lakes being small and insufficient for the escape of all the water banked up by the wind, return currents are inevitable.

The theory has often been propounded that many ocean currents arise from the above cause; the water driven before the wind making the current, and the piled-up water seeking an escape, forming the return current.

OTHER FEATURES.

Barometric changes, as well as other meteorological phenomena, may have an influence on the currents of the Great Lakes. A high pressure of the barometer lying over the southern end of Lake Michigan, for instance, will lower the water at that point, causing a difference of surface level between the two ends of the lake and a resulting flow of water to the southward. Such conditions, however, could hardly endure for any great length of time.

There also occurs occasionally on the Great Lakes a phenomenon which is called a "Seiche."

"These seiches* are uninodal, stationary vibrations of lake water. They appear in the form of waves, which alternately raise and depress the water of the lake on each side of the nodal line of the oscillation. * * *

"As the area of the Great Lakes is so large, the uninodal seiche would naturally be of infrequent occurrence, as a powerful blow must be struck on a comparatively large area to produce it.

"But this uninodal vibration does exist on the Great Lakes. Gen. C. B. Comstock states in the United States Chief of Engineer's Report for 1872, p. 1040, that there is a wave constantly passing between Milwaukee and Grand Haven on Lake Michigan. The tide gauges show that there are eleven great waves per day at each of these places, and the waves have a period of a trifle over two hours.

* * * * * * *

"A tracing of the tide gauge at Grand Haven, Mich., for the month of April, 1893, shows a two hour and twelve-minute period with great exactness. Every day in the month this period can be distinguished, although on some days it is almost obliterated by minute seiches, or "embroidery," while a crest is often marked by another superposed seiche in stormy weather; but the succeeding crest appears after the two-hour period. * * *

"In his report for 1872, General Comstock cites some remarkable seiches observed by Major Wilson at Oswego. The first one occurred on June 13, 1872. Its period was from twenty to thirty minutes, and during its continuance a white squall passed to the north, over the lake, accompanied by a small waterspout. An employee of the survey, who happened to be out on the lake, reported that he heard strange noises, bubbles came to the top of the water, and the fish rose to the surface as if stunned. * * *

"On Friday morning, April 7, 1893, the port of Chicago was visited by a tide wave, bore, a phenomenon called seiches, or in plain terms, a sudden vertical motion of the water in the southern portion of Lake Michigan, for it appears the wave swept over the beach at St. Joseph, Mich., 700 feet back from the high-water mark, the vertical rise at that point being given as 4 feet, a report which is duly authenticated from Chicago. At the latter port a recurring wave, which also characterized the St. Joseph phenomenon, caused great damage to the shipping and called forth the assistance of tugs and port officials to secure the disabled vessels broken adrift through the force of the tidal wave. * * *

"The following extract from a letter of H. C. Frankenfield, local forecast official at Chicago, will perhaps give a good idea of the weather conditions there on April 7, the date of the above-mentioned seiche:

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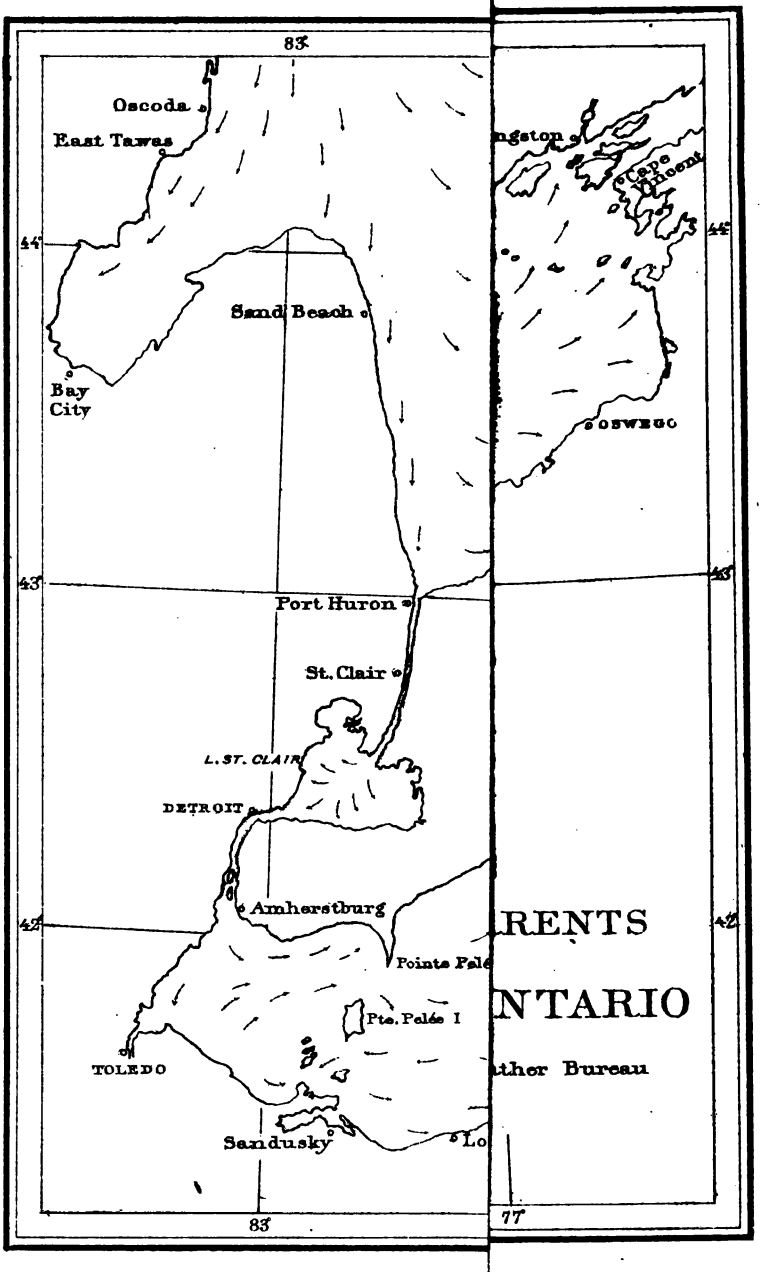
*Extracts from an article on "The Seiche in America," by E. A. Perkins. Published in the American Meteorological Journal, October, 1893.


83°
Oscoda
East Tawas
44°
Sand Beach
Bay City
43°
Port Huron
St. Clair
L. ST. CLAIR
DETROIT
Amherstburg
42°
Pointe Pelé
Pte. Pelée I
TOLEDO
Sandusky
83°
77°
OSWEGO
44°
43°
42°
RENTS
NTARIO
ther Bureau

"'High winds commenced about 2.30 p. m., April 6, blowing steadily from the SE. until 1.30 a. m., April 7, when they shifted to NNE., blowing from that quarter until 4 a. m., when they again went to SE. The velocity varied from 30 miles per hour at 2.30 p. m., April 6, to 43 miles per hour at 1.50 a. m., April 7.'

"'The wave occurred between 1.30 and 1.45 a. m., April 7, and its height was from 4 to 6 feet. The damage done was principally to vessels anchored in the river. Several were torn from their moorings and carried toward the lake, causing numerous collisions with other vessels. Some were carried out into the lake. I do not think the wave was preceded by smaller ones, but judging from the barometric oscillations after the principal wave, there must have been several smaller ones during the next two hours. These waves occur from time to time, and I have observed that they always occur at the time of a sudden and decided rise or fall in the barometer.' * * *

"I have received accounts of several minor seiches on the Great Lakes, but nothing that will bear comparison with the great seiche of April 7, 1893. This seems to be one of the largest oscillations ever observed on the lakes. It is to be regretted that synchronous observations of this phenomenon were not taken by tide gauges at different points on the shore.

"As to the forecasting of seiches, this can not be done with accuracy until we obtain further knowledge of the bore, and ascertain by numerous barographs the advance of sudden changes in the pressure of the atmosphere."

From the preceding remarks it will be seen that the steadiness and persistence of the lake currents have not yet been determined accurately. Their velocities have been found to vary in speed from 4 to 12 miles a day.

The prevalence of westerly and southwesterly winds favor the strength and persistence of these currents, and it must be remembered that when the motion of the surface water has been communicated to the strata below, a brief change of wind, while affecting the surface, is not so soon communicated to the underlying water.

CURRENTS IN LAKE ERIE.

A general northeasterly surface drift, rather more marked along the south coast.

A slight return current along the north coast west of Long Point Island.

A series of eddies among the islands in the western end, very variable in character.

This lake being very shallow, and its axis lying nearly in the direction of the prevailing winds, great inequalities of level may be noticed, depending upon the strength of the wind.

The velocity of the main current is about 6 miles a day in calm weather, but with heavy westerly winds it has been known to run at the rate of 10 miles an hour.

CURRENTS IN LAKE ONTARIO.

The general surface current is to the eastward, strongest along the south shore. There is no noticeable return current. West of a line joining Niagara and Whitby Point the currents are variable. There are seldom any great flunctuations of level in this lake. The velocity of the main current is about 8 miles a day.

CHAPTER XIV.

LIFE SAVING SERVICE.

[Extract from a lecture read before the Committee of Life-Saving Systems and Devices. International Marine Conference, November 22, 1889, by Sumner I. Kimball, General Superintendent of the United States Life Saving Service.]

The cluster of inland seas known as the Great Lakes contains an area of about 80,000 square miles, and has a coast line within the limits of the United States of nearly 2,500 miles. These seas are open to navigation about eight months in the year, at other times being closed by ice, although one or two steamers cut their way across Lake Michigan at intervals throughout the winter. There are few natural harbors, but a large number of artificial ones. These are formed at the mouths of the rivers by extending piers from their banks out into the lake for a considerable distance and dredging the bottom between. The lakes are generally tranquil, but at certain seasons are visited by violent gales, which throw their fresh waters into furious convulsion with a suddenness unknown upon the ocean. Vessels unable to hold their own against the severity of these storms, being landlocked and with scant sea room, are likely to be left with only the choice between stranding wherever they may be driven and seeking refuge in the harbor that seems most accessible. The latter course is naturally the one taken. To effect an entrance within the narrow space between the piers at such times with sailing vessels, and even with steamers, is frequently a task of extreme difficulty, and the luckless craft are liable to strand upon the bar on one or the other side of the piers and meet their destruction. At some of these harbors many disasters occur in a single day.

The numerous severe gales attending the opening and closing of navigation in the early spring and late fall cause great numbers of wrecks from the enormous shipping of the lakes. As the strandings usually occur near the harbors, however, the number of stations required is not so large as it would be if they were distributed more generally on the lakes. The number at present is forty-five.

In the majority of stations the first floor is divided into four rooms; a boat room, a mess room (also serving for a sitting room for the men), a keeper's room, and a storeroom. Wide, double-leafed doors and a sloping platform extending from the sills to the ground permit the running out of the heavier equipments from the building. The second story contains two rooms; one is the sleeping room of the men, the other has

spare cots for rescued people and is also used for storage. The more commodious stations have two additional rooms—a spare room and a kitchen. In localities where good water can not be otherwise obtained cisterns are provided for water caught from the roof. There surmounts every station a lookout or observatory, in which a day watch is kept. The roofs upon the stations on those portions of the coast exposed to view from the sea are usually painted dark red, which makes them distinguishable a long distance off shore. They are also marked by a flagstaff 60 feet high, used in signaling passing vessels by the international code.

The stations (other than the house of refuge) are generally equipped with two surfboats (supplied with oars, lifeboat compass, and other outfits), a boat carriage, two sets of breeches-buoy apparatus (including a Lyle gun and accessories), a cart for the transportation of the apparatus, a dozen signal rockets, a set of the signal flags of the international code, a medicine chest with contents, a barometer, a thermometer, patrol lanterns, patrol checks or patrol clocks, the requisite furniture for rude housekeeping by the crew and for the succor of rescued people, fuel and oil, tools for the repair of the boats and apparatus, and for minor repairs to the buildings, and the necessary books and stationery. At some of the stations the Hunt gun and projectiles are supplied, and at a few the Cunningham rocket apparatus. To facilitate the transportation of boats and apparatus to scenes of shipwreck, a pair of horses is also provided at stations where they can not be hired, and to those stations where the supplies, mails, etc., have to be brought by water a supply boat is furnished.

The few lake stations located upon the sand beaches are similar in all respects to those upon the seacoast, but those situated at the harbors differ from them in that room is provided for a heavy lifeboat and for a small boat, for quick work in the immediate vicinity of the station. The buildings are usually located not far from the water's edge, behind one of the piers of crib work forming the sides of the harbor entrance. An inclined platform, upon which are laid two tramways for the launching of the boats, extends from the boat room down to the water through an opening cut in the pier. Cradles or cars are provided on which the boats are kept mounted, and by which they can be put afloat with the men at their oars in half a minute. Exit from the surfboat wagon and apparatus cart is also provided in the rear of the building, in case it should be necessary to transport them along the shore. These stations usually have telephone connection with the systems of the adjacent towns.

The law provides that the stations on the Atlantic and Gulf coasts shall be opened and manned for active service from the first day of September in each year until the first day of the succeeding May, and those on the lake coasts from the opening to the close of navigation, usually from about the 15th of April to about the 15th of December.

For the purpose of watch and patrol the district officers establish patrol limits as far as practicable along the coast in both directions from the stations, marking them by distinct monuments, and a description of the beats thus laid out is sent to the office of the general superintendent. The day watch is kept from sunrise to sunset by a surfman daily assigned to this duty, who is usually stationed in the lookout, and who, if the patrol limits can not be seen from there, goes at least three times a day far enough along the shore to bring them into view. During thick and stormy weather a complete patrol like that at night is maintained. At the harbor stations on the lakes, at the river station at Louisville, and at other places where accidents are frequent, there is connected with the lookout a gong, by means of which the crew is alarmed when occasion requires. The day watch keeps a record of all passing vessels.

For the night patrol the night is divided into four watches—one from sunset to 8 o'clock, one from 8 to 12, one from 12 to 4, and one from 4 to sunrise. Two surfmen are designated for each watch. When the hour for their patrol arrives they set out in opposite directions along the coast, keeping as near as practicable to the shore, as far as the ends of their respective beats. If within communicating distance from an adjacent station, each patrolman proceeds until he meets another from the next station, and gives him a metallic check marked with his station and crew number, receiving in exchange a similar one. The checks thus collected are examined by the keeper, recorded in the journal, and returned to their proper stations the next night. If a patrolman fails to meet his fellow from the adjacent station, after waiting a reasonable length of time at the usual place of meeting, he continues his journey until he either meets him or reaches that station and ascertains the cause of the failure, which, on his return, he reports to his keeper, who makes a record of it in his journal.

At isolated stations each patrolman is required to carry a clock, within which is fixed a dial that can be marked only by means of a key which also registers the time of marking. This key is secured to a post at the end of his beat, and he is required to reach it and bring back the dial properly marked.

Each patrolman is equipped with a beach lantern and several red Coston hand lights. Upon the discovery of a wreck, a vessel in distress, or one running dangerously near the shore, he ignites by percussion his hand light, which emits a brilliant red flame. This serves the double purpose of warning the people on the vessel of their danger and of assuring them of succor if they are already in distress.

INSTRUCTIONS TO MARINERS IN CASE OF SHIPWRECK.

The accompanying information is compiled from a pocket manual, entitled "Instructions to Mariners in case of Shipwreck," issued by the United

States Life Saving Service. A knowledge of the facts here stated may be of vital importance in case of shipwreck, and should be familiar to every navigator along our coasts..

GENERAL INFORMATION.

Life Saving stations, lifeboat stations, and houses of refuge are located upon the Atlantic and Pacific seaboard of the United States, the Gulf of Mexico, and the Lake coasts.

All stations upon the Pacific Coast are open and manned the year around, with the exception of the station at Cape Arago, which depends upon volunteer effort from the neighboring people in case of shipwreck.

All life saving and lifeboat stations are fully supplied with boats, wreck guns, beach apparatus, restoratives, etc.

Houses of refuge are supplied with boats, provisions, and restoratives, but not manned by crews; a keeper, however, resides in each throughout the year, who, after every storm, is required to make extended excursions along the coast, with a view of ascertaining if any shipwreck has occurred and finding and succoring any persons that may have been cast ashore.

Masters are particularly cautioned, if they should be driven ashore anywhere in the neighborhood of the stations, especially on any of the sandy coasts where there is not much danger of vessels breaking up immediately, to remain on board until assistance arrives, and under no circumstances should they attempt to land through the surf in their own boats until the last hope of assistance from the shore has vanished.

SPECIAL SIGNALS BETWEEN SHIP AND SHORE.

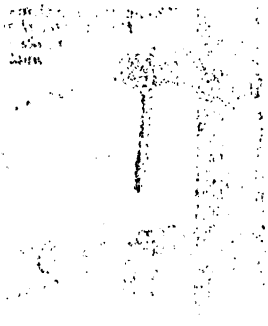
The following signals, approved by the International Marine Conference convened at Washington in October, 1889, have been adopted by the Life Saving Service, and will be used and recognized by the officers and employees as occasion may require:

"Upon the discovery of a wreck by night, the life saving force will burn a red pyrotechnic light or a red rocket to signify—'You are seen; assistance will be given as soon as possible.'

"A red flag waved on shore by day, or a red light, red rocket, or red Roman candle displayed by night, will signify—'Haul away.'

"A white flag waved on shore by day, or a white light slowly swung back and forth, or a white rocket, or white Roman candle fired by night, will signify—'Slack away.'

"Two flags, a white and a red, waved at the same time on shore by day, or two lights, a white and a red, slowly swung at the same time, or a blue pyrotechnic light burned by night, will signify—'Do not attempt to land in your own boats. It is impossible.'



The foregoing instructions being complied with, the result will be shown in Figure 1.

As soon as your signal is seen a three-inch hawser will be bent on to the whip and hauled off to your ship by the life-saving crew.

If circumstances will admit, you can assist the life-saving crew by manning that part of the whip to which the hawser is bent and hauling with them.

When the end of the hawser is got on board a tally-board will be found attached, bearing the following directions in English on one side and French on the other.

"Make this hawser fast about two feet above the tail-block, see all clear and that the rope in the block runs free, and show signal to the shore."

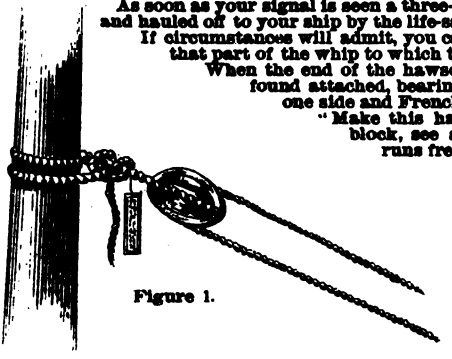


Figure 1.

These instructions being obeyed, the result will be shown in Figure 2. *Take particular care that there are no turns of the whip-line around the hawser. To prevent this take the end of the hawser* UP BETWEEN *the parts of the whip before making it fast.* When the hawser is made fast, the whip cast off from the hawser, and your signal seen by the life-saving crew, they will haul the hawser taut and by means of the whip will haul off to your ship a breeches-buoy suspended from a traveler-block, or a life-car from rings, running on the hawser.

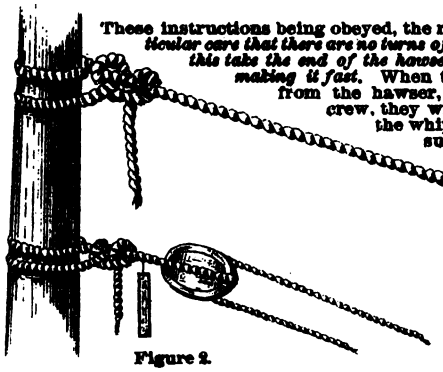


Figure 2.

Figure 3 represents the apparatus rigged, with the breeches-buoy hauled off to the ship. If the breeches-buoy be sent, let one man immediately get into it, thrusting his legs through the breeches. If the life-car, remove the hatch, place as many persons into it as it will hold (four to six), and secure the hatch on the outside by the hatch-bar and hook, signal as before, and the buoy or car will be hauled ashore. This will be repeated until all are landed. On the last trip of the life-car the hatch must be secured by the inside hatch-bar. In many instances two men can be landed in the breeches-buoy at the same time by each putting a leg through a leg of the breeches and holding on to the lifts of the buoy.

Children, when brought ashore by the buoy, should be in the arms of older persons or securely lashed to the buoy.

Women and children should be landed first.

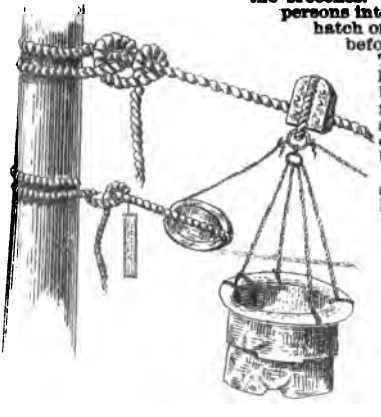


Figure 3.

"A man on shore beckoning by day, or two torches burning near together by night, will signify—'This is the best place to land.'

"Any of these signals may be answered from the vessels as follows: In the daytime, by waving a flag, a handkerchief, a hat, or even the hand; at night, by firing a rocket, a blue light, or a gun, or by showing a light over the ship's gunwale for a short time, and then concealing it."

INSTRUCTIONS.

Rescue with the Lifeboat or Surf boat.

The patrolman, after discovering your vessel ashore and burning a Coston signal, hastens to his station for assistance. If the use of a boat is practicable, either the large lifeboat is launched from its ways in the station and proceeds to the wreck by water, or the lighter surf boat is hauled overland to a point opposite the wreck and launched, as circumstances may require.

Rescue with the Breeches Buoy or Life Car.

Should it be inexpedient to use either the lifeboat or surf boat, recourse will be had to the wreck gun and beach apparatus for the rescue by the breeches buoy or the life car.

A shot with a small line attached will be fired across your vessel. Get hold of the line as soon as possible and haul on board until you get a tail block with a whip or endless line rove through it. This tail block should be hauled on board as quickly as possible to prevent the whip drifting off with the set or fouling with wreckage, etc. Therefore, if you have been driven into the rigging, where but one or two men can work to advantage, cut the shot line and run it through some available block, such as the throat or peak-halyards block, or any block which will afford a clear lead, or even between the ratlines, that as many as possible may assist in hauling.

Attached to the tail block will be a tally board with the following directions in English on one side and French on the other:

"Make the tail of the block fast to the lower mast, well up. If the masts are gone, then to the best place you can find. Cast off shot line, see that the rope in the block runs free, and show signal to the shore."

RECAPITULATION.

Remain by the wreck until assistance arrives from the shore, unless your vessel shows signs of immediately breaking up.

If not discovered immediately by the patrol, burn rockets, flare up, or other lights, or, if the weather is foggy, fire guns.

Take particular care that there are no turns of the whip-line round the hawser before making the hawser fast.

Send the women, children, helpless persons, and passengers ashore first.

Make yourself thoroughly familiar with these instructions, and remember that on your coolness and strict attention to them will greatly depend the chances of success in bringing you and your people safely to land.

CHAPTER XV.

GENERAL INFORMATION.

The publications of the United States Hydrographic Office for the use of mariners, comprise charts, sailing directions, and light lists, also special books and pamphlets, issued from time to time. They are subject to frequent correction, for information relative to changes in natural and artificial features received subsequent to the date of publication.

The scheme of chart publication embraces three general classes of charts:

1. **General or Sailing Charts**, which cover a large area, and are, therefore, on a comparatively small scale. These are used for laying down routes and proceeding along them. They are for general cruising purposes.

2. **Coast Charts**, which cover less area than the general or sailing charts, and are commonly on a larger scale. They are used for coasting, and for making and leaving the land.

3. **Harbor Charts** are special charts of localities, and are intended for piloting, and for various other local purposes.

For example: A vessel at sea and out of sight of land would use a general or sailing chart. On sighting land, the coast chart would be resorted to, and for entering harbor, the harbor chart would be used.

Sailing directions give additional information, to supplement that contained on the charts, and in greater detail. Light lists also supplement the charts by giving fuller information relative to lights and fog signals. There are also buoy lists published, which give, according to the latest information, the position and character of buoys, beacons, and day marks. These lists serve as checks upon the correctness of the charts.

The effort of the Hydrographic Office is to issue charts which shall be correct up to the date of issue, so far as information at hand permits. In the use of all Hydrographic Office publications, the date of issue should be considered.

Light Lists, published by the Hydrographic Office, which have been corrected for the latest information, are also issued. In cases where light lists published by other departments or nations are issued, the Hydrographic Office is not responsible for their correctness.

Sailing Directions can not, from their nature, be kept fully corrected by the Hydrographic Office by the insertion of slips, etc. Their date of

issue should always be carefully considered, and where they differ from charts of later issue, the chart should be taken as the guide.

Notice to Mariners.—In order that charts, sailing directions, etc., may be corrected for information received at the Hydrographic Office subsequent to the date of issue, weekly publications, styled "Notices to Mariners," are issued by the Hydrographic Office to the public free of charge. The Notices to Mariners contain brief itemized statements of special information received. The items are in such shape that they may be cut from the Notices to Mariners and pasted in books, on charts, and in the Light Lists. The Notices to Mariners also mention the publications that are affected by the several items of information. A list of charts issued and cancelled by the Hydrographic Office, and of the books published, is given in the first notice of each month.

It is seen that this scheme of supply and information assumes that navigators will keep themselves supplied with Notices to Mariners, Supplements, Light Lists, etc., in order that they may keep publications already in their possession corrected for the latest information. Notices to Mariners are supplied from the main Hydrographic Office, in the Navy Department, at Washington, D. C., or from any of the Branch Hydrographic Offices, of which there are twelve. The Branch Hydrographic Offices upon the Great Lakes are in the Masonic Temple at Chicago, and in the Arcade Building at Cleveland.

For the correction of Sailing Directions, supplements to the several volumes are published from time to time.

THE USE OF CHARTS.

It is obvious that the value of a chart can never be greater than the value of the survey from which it is made. A correct chart can not be made from an incorrect survey. Given an accurate survey, the appearance or character of a chart may be varied to suit the taste or need of those interested in its use. For mariners, all needless detail is commonly discarded in order that the information contained upon the chart may be impressed quickly upon the mind. Although the charts of the Great Lakes, as a rule, proceed from painstaking surveys, this is not true of all charts, especially certain charts of foreign coasts. To the experienced eye, the appearance of a chart affords a good basis of judgment as to its trustworthiness. In scanning a chart to judge of its value, certain points should be noticed, viz: the date of the survey and by whom the survey was made; the date of issue of the chart; the date at which it has received general correction, and the date at which it has received special corrections. As a rule it may be said that recent surveys are more accurate than those made many years ago. In many places the character of the bottom undergoes change, making resurveys necessary. For such places an old chart

should be accepted with caution. Where charted soundings are distributed evenly over a certain area, but are well opened out one from another, it does not mean necessarily that the soundings shown are all that were taken during the survey. The Hydrographic Office engraves upon its charts only characteristic soundings, and discards for the purpose of chart making soundings which are superfluous. If, on a chart intended to show details, there are no soundings placed over certain areas where they would ordinarily be expected to appear, it may mean that no survey has been made of the vacant areas. It is often the case, however, that soundings are not shown beyond a certain depth of water.

Even in the best surveys a detached pinnacle of rock or other submerged danger may not be discovered. This applies especially to rocky coasts and to the vicinity of outlying rocks. As a rule, therefore, rocky shores and patches should be given a reasonable berth. In using a chart, the notes printed upon it should be carefully read. It may be that charts published by different offices are based upon different plans. For example, one may refer to magnetic courses, and the other to true courses; one may give the bearings of an object on shore as taken from the vessel, and the other the bearing of the vessel from the object on shore. In respect to seaboard charts, one may give depths for mean low water, while the soundings on the other may refer to low water of spring tides, etc. It should also be noted whether the soundings indicate fathoms or feet. In some cases fathoms only are used; in others, only feet; while in other cases feet are designated to depths of three (3) fathoms, beyond which fathoms are shown. In the last case the water areas in depths less than three (3) fathoms or eighteen (18) feet, are dotted or "sanded."

DISTORTION OF CHARTS.

Charts printed from copperplates are subject to distortion. They are printed necessarily on dampened paper. By reason of the dampness the paper has expanded, especially in one direction; that is to say, in the direction in which the fiber of the paper runs. The dimensions of the printed chart coincide with those of the plate immediately after leaving the press, but, in drying, the paper contracts to its original dimensions, thus distorting the printed matter. Different degrees of dampness produce different degrees of distortion. It may be, therefore, that charts printed from the same chart plate at different times and under different conditions of dampness, will not coincide in all their parts if one is superimposed on the other. When this distortion takes place the compass and graduated scales on the chart are distorted in the same ratio as other matter, hence, for the purposes of navigation, no harm is likely to result from the use of plate-printed charts.

As a rule, a chart of the largest scale available should be used for

coasting and piloting. For pursuing an extended route with plenty of sea room, there is an advantage in using a chart covering greater area on which both the port of destination and of departure are shown. It should be remembered, however, that in laying down a position from compass bearings, a small error of observation, when plotted, is likely to result in less displacement of position on a chart of a large scale than on one of a small scale. In one case it may reach only yards, and in the other a considerable fraction of a mile. In laying off compass bearings on the chart for fixing a position, bearings on near objects should be used in preference to those on remote objects, because an error in observing the bearing of an object by compass, would have greater effect if continued on the chart through a long distance than through a short distance. Light Lists should always be referred to, as well as the chart, in order to obtain full details of lights. Buoy Lists of the latest issue should also be used to note, when visiting a strange port, if the buoys have been plotted upon the chart according to the latest position assigned to them. In using a Light List it should be remembered, in respect to the range of visibility of a light, as given therein, that it is true only for a certain height of the eye above the water. This is commonly about fifteen (15) feet. If the eye is higher, the light should be seen farther in clear weather, and if the eye is lower, the reverse should be the case. Commonly, the meaning is, that with the eye fifteen (15) feet above water, the light will dip below the horizon when the observer is a greater distance from the light than that of the tabulated range of visibility. Sometimes, however, a light may be so high above the water that the rule as to the range of visibility would give a range beyond the carrying power of the light itself. In such cases the range of visibility is oftentimes assigned on the basis of the power of the light. A good idea of the power of the light may be formed from noting its *order* as given in the Light List.

FOG SIGNALS.

In respect to fog signals, it is almost impossible to lay down any rule as to the range of audibility. The intensity of the sound and its apparent direction are very much influenced by the wind, and to such an extent that the signal may be heard from a remote distance and yet be inaudible or very faint when nearer. Mariners should beware of placing implicit confidence in fog signals.

VESSEL'S POSITION.

Good nautical practice requires that the master of a vessel shall know continuously the position of his vessel. In well-known channels or lanes of travel, simple visual observation may give him this information close enough for practical purposes; otherwise, he must resort to the use of his nautical charts and instruments. It is especially important that a

vessel's position should be accurately plotted upon a chart when thick weather shuts out the landmarks. On extended cruises at sea astronomical observations are the main resort of navigators for finding position, but when land is in sight closer results are obtained from compass bearings of landmarks or angular intervals between them, as ascertained by obsérvations on board the vessel. This latter practice embraces two distinct operations. First, taking the observation with the proper instruments of navigation. Second, plotting the results of the observation upon the chart to ascertain the position. The Hydrographic Office charts are plentifully supplied with compass "roses," which give both true and magnetic bearings, marked both for degrees and for compass points.

In using a chart, the theory is that the chart represents with sufficient accuracy a certain area of the surface of the globe over which the vessel is to pursue her way, and that by geometrical processes, very simple in principle, the mariner reproduces upon the chart the actual progress of his vessel along the surface of the globe. Upon the chart various landmarks are printed, all being correctly placed in their mutual relation. If at any time the master of a vessel takes a compass bearing of each of two charted landmarks, and then by means of the compass rose, plots or draws the bearings upon the chart, the intersection of the two plotted lines of bearing, if the objects have been suitably chosen, will intersect upon the chart in the position which corresponds to the actual position of the vessel in the water or upon the globe.

In taking compass bearings it should be borne in mind that certain disturbing influences enter: First, bearings taken with any compass whatever, give only what is called the magnetic bearing of the object, and not the true bearing. This disturbance is caused by the magnetism of the earth, which varies with the locality. To correct any bad results that might proceed from this cause, some charts are provided with lines or figures showing the amount of the magnetic variation in certain localities, and also with compass roses, in different portions of the chart, arranged to correspond with the actual compass in each place, if the compass were not otherwise influenced than by the magnetism of the earth. When the compass is not otherwise influenced, magnetic observations taken by means of the ship's compass, may be laid off on the chart by using the *magnetic* compass roses. Second, in using compass bearings to obtain the ship's position, note must be taken of the error which arises from the effect upon her compass of the iron on board at the time of taking the bearings. This is serious because it differs for different ships, and even for the same ship with a different cargo, or a different arrangement of cargo, when iron enters into the question. It is oftentimes very great in amount, but may be corrected by mechanical means so as to be confined within reasonable limits, so long as the amount and disposition of the iron on

board remains unchanged. If the iron, however, is changed, the local deviation, that is to say, the deviation due to the iron on board the ship, may also change, and very greatly. In order to use compass bearings effectively, for ascertaining the position of a ship, her local deviation on each course, or on each heading of the ship, should be known and applied, since it varies with the course of the ship.

Several methods of obtaining position by means of compass bearings will be given, also the method by means of "horizontal angles." The latter, although not widely practiced by mariners, is incomparably the safer method, especially in order to get a very accurate position of the vessel when the probability of thick weather warns the navigator that he may be obliged to continue his way upon the chart without landmarks in sight, and that he should have a well defined position from which to take a departure. This method eliminates the question of compass error.

Frequently landmarks which are in range, if accurately charted, afford a certain and handy means for obtaining a position. For example, a ship may proceed upon one range which leads over a route or through a channel until she arrives upon another range, when she may perhaps change her course. A chart upon which these ranges are laid down gives at a glance the intersection of the ranges, and therefore, the position of the vessel at the time when both ranges were on.

When the chart is accurate, one compass bearing, or a range, taken in connection with a sounding, may at times give a very trustworthy position, the place of the vessel being pricked off upon the chart where the lines of bearing, or the range line, cuts the depth of water found by getting casts of the lead aboard the vessel.

Another method is by noting when two objects are in range, and then taking with a sextant or alidade, marked to degrees, at least, the horizontal angle at the vessel between the objects in range and a third object conveniently situated. The range is then penciled upon the chart and the angle laid off by means of a metal protractor, or a protractor printed upon tracing paper.

Cross-compass bearings on two landmarks have already been mentioned. When the local deviation of the compass is known, this method, it must be admitted, is more frequently used than any other; but when the vessel has much rolling or pitching motion, compass bearings are difficult to take, entirely aside from the question of local deviation. In plotting lines of bearings, the mutual relations of the lines representing angles or intersections must be considered. If the lines converge sharply upon the chart, that is to say, if the angle between the lines is small, the lines will run along each other so as to make the actual point of intersection difficult to ascertain. It is necessary, therefore, to choose such objects on shore as will give a good intersection of lines upon the chart. The

perfect intersection is when the lines cross at an angle of 8 compass points or 90°. Two compass points, or 22° 30′, is considered too small, or, at least, barely acceptable.

Sometimes a compass bearing of a single object on shore may be taken and combined with the horizontal angle at the vessel between that landmark and some other landmark which is shown upon the chart.

The best method, as already stated, because it entirely avoids compass errors, is that by two horizontal angles known among mariners as the "three point problem." For the purpose of observation there is needed a sextant, which, by the way, may be used by any one reasonably expert, even when a vessel is rolling and pitching heavily, or an alidade mounted upon a compass or otherwise mounted, and graduated to degrees, at least. By means of the sextant or the alidade, the horizontal angle, at the vessel, between two objects upon the land, known to be charted, is observed, and in connection therewith there is also observed at the same time a second angle at the vessel between one of these two landmarks and a third landmark also charted. By means of a metal or horn protractor, or a protractor printed upon tracing paper, these two angles may be transferred to the chart by so placing the sides of the angles that the several sides shall fall respectively upon the proper landmarks at the same time. The common apex of the angles is then the position of the ship for the time the angles were observed. This is the common method employed in surveying to determine the positions of the soundings which are to be placed upon the charts for the use of navigators. Habitual resort to this method will very much enhance the safety of the vessel.

Certain handy problems, in which the run of the vessel enters, are also employed to obtain the position of the ship from the observation of a single landmark. These are given and illustrated as follows:

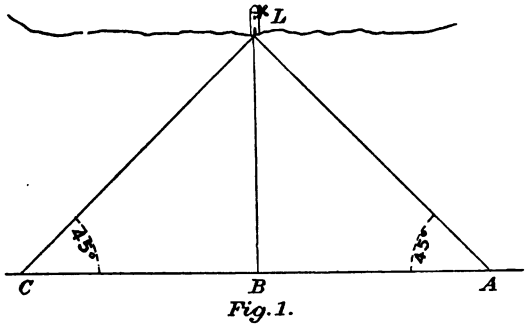


Fig. 1.

In figure 1, a vessel proceeding on her way from A to B takes a bearing of the landmark L when it bears 4 points on the bow, that is to say, 4

NOTE.—This is demonstrated as follows: The angle LBA is a right angle, and the angle BAL an angle of 45°, each having been so taken. The angle BLA is, therefore, an angle of 45°, the triangle LBA isosceles, and the side LB equal to the side BA.

points or 45° from the course on which the vessel is steering. Without changing her course, the vessel notes at B, when the landmark comes exactly abeam, the distance run by the vessel from A to B. If there has been no current to give a wrong impression of the distance run, or to deviate the ship from the course steered, the distance LB, of the ship from the landmark, when the ship is at B and the landmark bears abeam, is equal to the distance AB made by the ship between the two bearings A and B respectively.

A check on the correctness of the position at B may be had by noting the distance run from B when the landmark is 4 points or 45° on the quarter; that is to say, when the vessel is at C. In this case, again, the distance run from B to C gives the distance of the vessel from the landmark when she was at B. This is known by sailors as the "bow-and-beam-bearing" method, and is regarded as a great convenience. It is not always possible to employ this method, however.

The following more general graphical construction may be used with bearings of a single object when the lines of bearing intersect conveniently.

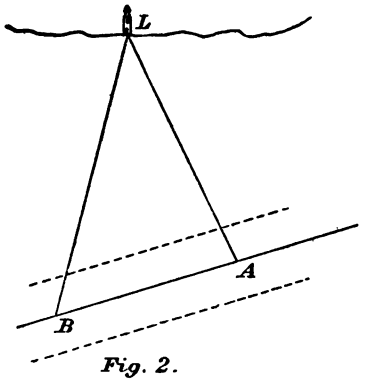


Fig. 2.

In figure 2, a vessel proceeds in the direction A to B without changing her course. At both A and B she takes a compass bearing of the landmark L, and at B notes the distance run on her course from A to B. A parallel ruler is set to the course AB by means of the compass rose on the chart, and the distance run from A to B is taken from the scale of the chart with a pair of dividers. The parallel rulers are then moved to and fro as shown by the dotted lines, and the dividers are applied to its edge until the parallel line AB is found, on which the intercepted distance AB is exactly spanned by the dividers as set by the scale. The line AB then represents upon the chart the course of the vessel, A, the point where she took her first bearing, and B the point where she took her second bearing.

THE COMPASS.

Points.	Number.	Degrees.			Number.	Points.
		°	′	″		
North.	0	0	0	0	0	South.
	1/8	1	24	22	1/8	
	1/4	2	48	45	1/4	
	3/8	4	13	7	3/8	
	1/2	5	37	30	1/2	
	5/8	7	1	52	5/8	
	3/4	8	26	15	3/4	
	7/8	9	50	37	7/8	
N. by E.—N. by W.	1	11	15	0	1	S. by W.—S. by E.
	1/8	12	39	22	1/8	
	1/4	14	3	45	1/4	
	3/8	15	28	7	3/8	
	1/2	16	52	30	1/2	
	5/8	18	16	52	5/8	
	3/4	19	41	15	3/4	
	7/8	21	5	37	7/8	
NNE.—NNW.	2	22	30	0	2	SSW.—SSE.
	1/8	23	54	22	1/8	
	1/4	25	18	45	1/4	
	3/8	26	43	7	3/8	
	1/2	28	7	30	1/2	
	5/8	29	31	52	5/8	
	3/4	30	56	15	3/4	
	7/8	32	20	37	7/8	
NE. by N.—NW. by N.	3	33	45	0	3	SW. by S.—SE. by S.
	1/8	35	9	22	1/8	
	1/4	36	33	45	1/4	
	3/8	37	58	7	3/8	
	1/2	39	22	30	1/2	
	5/8	40	46	52	5/8	
	3/4	42	11	15	3/4	
	7/8	43	35	37	7/8	
NE.—NW.	4	45	0	0	4	SW.—SE.
	1/8	46	24	22	1/8	
	1/4	47	48	45	1/4	
	3/8	49	13	7	3/8	
	1/2	50	37	30	1/2	
	5/8	52	1	52	5/8	
	3/4	53	26	15	3/4	
	7/8	54	50	37	7/8	

THE COMPASS —*Continued.*

Points.	Number.	Degrees.			Number.	Points.
		°	′	″		
NE. by E.—NW. by W.	5	56	15	0	5	SW. by W.—SE. by E.
	1/8	57	39	22	1/8	
	1/4	59	3	45	1/4	
	3/8	60	28	7	3/8	
	1/2	61	52	30	1/2	
	5/8	63	16	52	5/8	
	3/4	64	41	15	3/4	
	7/8	66	5	37	7/8	
ENE.—WNW.	6	67	30	0	6	WSW.—ESE.
	1/8	68	54	22	1/8	
	1/4	70	18	45	1/4	
	3/8	71	43	7	3/8	
	1/2	73	7	30	1/2	
	5/8	74	31	52	5/8	
	3/4	75	56	15	3/4	
	7/8	77	20	37	7/8	
E. by N.—W. by N.	7	78	45	0	7	W. by S.—E. by S.
	1/8	80	9	22	1/8	
	1/4	81	33	45	1/4	
	3/8	82	58	7	3/8	
	1/2	84	22	30	1/2	
	5/8	85	46	52	5/8	
	3/4	87	11	15	3/4	
	7/8	88	35	37	7/8	
East.—West.	8	90	0	0	8	West.—East.

TABLE FOR CONVERTING STATUTE MILES INTO SEA MILES.

1 statute mile = 5,280 feet.
1 sea mile or knot = 6,080 feet.

Statute miles.	Sea miles.	Statute miles.	Sea miles.	Statute miles.	Sea miles.
1.00	0.868	9.00	7.815	17.00	14.763
1.25	1.085	9.25	8.032	17.25	14.980
1.50	1.302	9.50	8.249	17.50	15.197
1.75	1.519	9.75	8.467	17.75	15.414
2.00	1.736	10.00	8.684	18.00	15.632
2.25	1.953	10.25	8.901	18.25	15.849
2.50	2.171	10.50	9.118	18.50	16.066
2.75	2.387	10.75	9.335	18.75	16.283
3.00	2.604	11.00	9.552	19.00	16.500
3.25	2.821	11.25	9.769	19.25	16.717
3.50	3.038	11.50	9.986	19.50	16.934
3.75	3.256	11.75	10.203	19.75	17.151
4.00	3.473	12.00	10.420	20.00	17.369
4.25	3.690	12.25	10.638	20.25	17.586
4.50	3.907	12.50	10.855	20.50	17.803
4.75	4.124	12.75	11.072	20.75	18.020
5.00	4.341	13.00	11.289	21.00	18.237
5.25	4.559	13.25	11.507	21.25	18.454
5.50	4.776	13.50	11.724	21.50	18.671
5.75	4.994	13.75	11.941	21.75	18.888
6.00	5.211	14.00	12.158	22.00	19.105
6.25	5.428	14.25	12.376	22.25	19.322
6.50	5.645	14.50	12.593	22.50	19.539
6.75	5.862	14.75	12.810	22.75	19.756
7.00	6.079	15.00	13.027	23.00	19.973
7.25	6.296	15.25	13.244	23.25	20.191
7.50	6.513	15.50	13.461	23.50	20.408
7.75	6.730	15.75	13.678	23.75	20.625
8.00	6.947	16.00	13.895	24.00	20.842
8.25	7.164	16.25	14.112	24.25	21.060
8.50	7.381	16.50	14.329	24.50	21.277
8.75	7.598	16.75	14.546	25.00	21.711
¼	0.217	½	0.434	¾	0.651

TABLE FOR CONVERTING SEA MILES INTO STATUTE MILES.

1 sea mile or knot = 6,080 feet.
1 statute mile = 5,280 feet.

Sea miles.	Statute miles.	Sea miles.	Statute miles.	Sea miles.	Statute miles.
1.00	1.151	8.75	10.075	16.50	18.999
1.25	1.439	9.00	10.363	16.75	19.287
1.50	1.729	9.25	10.651	17.00	19.575
1.75	2.015	9.50	10.939	17.25	19.863
2.00	2.303	9.75	11.227	17.50	20.151
2.25	2.590	10.00	11.515	17.75	20.439
2.50	2.878	10.25	11.803	18.00	20.727
2.75	3.166	10.50	12.090	18.25	21.015
3.00	3.454	10.75	12.378	18.50	21.303
3.25	3.742	11.00	12.666	18.75	21.590
3.50	4.030	11.25	12.954	19.00	21.878
3.75	4.318	11.50	13.242	19.25	22.166
4.00	4.606	11.75	13.530	19.50	22.454
4.25	4.893	12.00	13.818	19.75	22.742
4.50	5.181	12.25	14.106	20.00	23.030
4.75	5.469	12.50	14.393	20.25	23.318
5.00	5.757	12.75	14.681	20.50	23.606
5.25	6.045	13.00	14.969	20.75	23.893
5.50	6.333	13.25	15.257	21.00	24.181
5.75	6.621	13.50	15.545	21.25	24.468
6.00	6.909	13.75	15.833	21.50	24.757
6.25	7.196	14.00	16.121	21.75	25.045
6.50	7.484	14.25	16.409	22.00	25.333
6.75	7.772	14.50	16.696	22.25	25.621
7.00	8.060	14.75	16.984	22.50	25.909
7.25	8.348	15.00	17.272	22.75	26.196
7.50	8.636	15.25	17.560	23.00	26.484
7.75	8.924	15.50	17.848	23.50	27.000
8.00	9.212	15.75	18.136	24.00	27.636
8.25	9.500	16.00	18.424	24.50	28.212
8.50	9.787	16.25	18.712	25.00	28.787

DRAFT IN SALT AND FRESH WATER.

With regard to the amount a vessel will rise in passing from fresh to salt water, the following table shows approximately:

Moulded depth in feet.	Approximate amount of rise of a vessel passing from fresh to sea water.		
	Vessels without erections on deck.	Awning deck vessels.	Spar deck vessels.
	Inches.	*Inches.*	*Inches.*
9 and under 11	2	----------	----------
11 and under 13	2½	----------	----------
13 and under 16	3	3½	4
16 and under 19	3½	4	4½
19 and under 22	4	4½	5
22 and under 25	4½	5	5½
25 and under 28	5	5½	6
28 and under 31	5½	6	6½
31 and under 34	6	6½	7

The weight of a cubic foot of salt water being taken to be 64 pounds; that of fresh water 62.5 pounds.

This table applies, as a general rule, for all except those of extremely full or extremely fine form.

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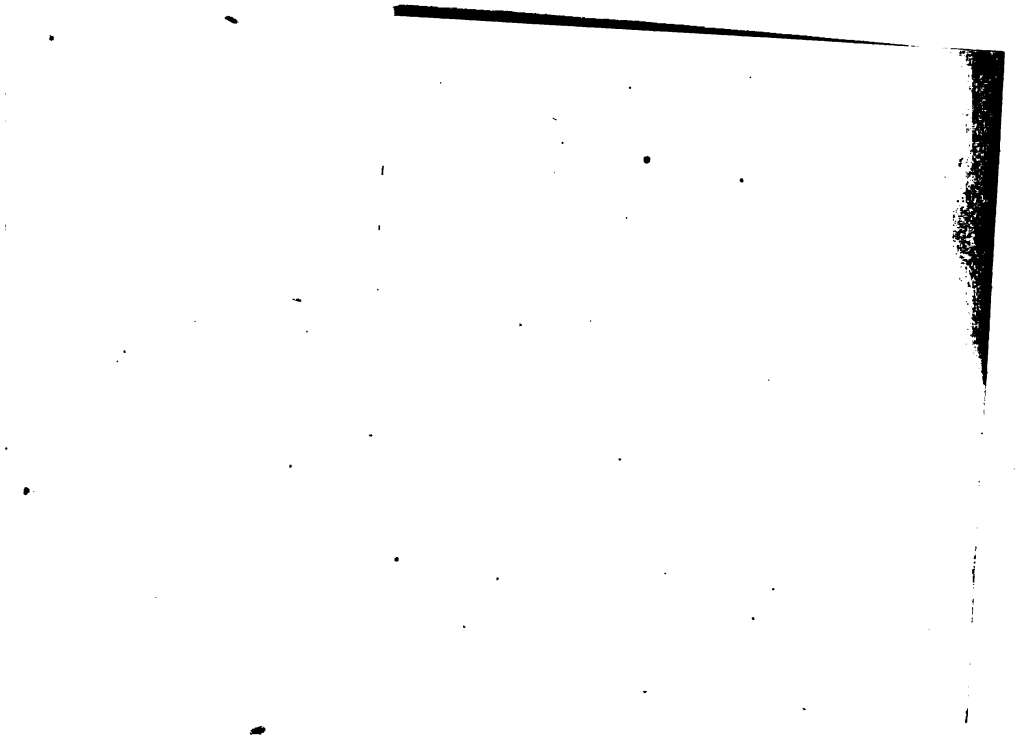
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